

# Exhibit 1

(Part 1)

**IN THE UNITED STATES DISTRICT COURT  
FOR THE SOUTHERN DISTRICT OF NEW YORK**

ALASKA ELECTRICAL PENSION FUND, et  
al.,

Plaintiffs,

VS.

BANK OF AMERICA, N.A.; BARCLAYS BANK PLC; B.N.P. PARIBAS SA; CITIGROUP INC.; CREDIT SUISSE AG, NEW YORK BRANCH; DEUTSCHE BANK AG; THE GOLDMAN SACHS GROUP, INC.; HSBC BANK USA, N.A.; ICAP CAPITAL MARKETS LLC; JPMORGAN CHASE & CO.; MORGAN STANLEY & CO. LLC; NOMURA SECURITIES INTERNATIONAL, INC.; ROYAL BANK OF SCOTLAND PLC; UBS AG; and WELLS FARGO BANK, N.A.,

Defendants.

Lead Case No.: 14-cv-7126(JMF)

## Consolidated Cases

14-cv-7907 (JMF)

14-cv-8342 (JMF)

14-cv-8365 (JMF)

14-cv-8576 (JMF)

## EXPERT REPORT OF MICHAEL A. WILLIAMS, PH.D.

**JULY 28, 2017**

**HIGHLY CONFIDENTIAL**  
**SUBJECT TO PROTECTIVE ORDER**

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I. INTRODUCTION

A. *Summary of qualifications*

1. My name is Michael A. Williams. I am a Director at Competition Economics, LLC. I specialize in analyses involving antitrust, industrial organization, and regulation. I have published articles in a number of academic journals, including *Proceedings of the National Academy of Sciences*, *American Economic Review*, *Journal of Law and Economics*, *International Journal of Industrial Organization*, *Journal of Industrial Economics*, *Physica A*, *Journal of Economics and Management Strategy*, *Economics Letters*, *Journal of Public Economic Theory*, *Behavioral Science*, *Review of Industrial Organization*, *Antitrust Bulletin*, *Texas Law Review*, and the *Yale Journal on Regulation*.

2. I have provided testimony before the United States District Court, Middle District of Alabama; United States District Court, Central and Northern Districts of California; United States District Court, Northern District of Georgia; United States District Court, District of Kansas; United States District Court, District of Massachusetts; United States District Court, District of Minnesota; United States District Court, District of New Jersey; United States District Court, Southern District of New York; United States District Court, Eastern District of Pennsylvania; United States District Court, Eastern District of Tennessee; United States District Court, Northern District of Texas; United States Court of Federal Claims; State of Connecticut, Superior Court; State of New Mexico, Second Judicial District; State of Nevada, Gaming Commission and State Gaming Control Board; and public utilities commissions in Arkansas, Hawaii, Michigan, Minnesota, Missouri, Nebraska, New Mexico, Texas, and Washington.

3. I have been retained as an economic consultant by the U.S. Department of Justice, Antitrust Division; the U.S. Federal Trade Commission; and the Canadian Competition Bureau.

4. Previously, I was an economist with the U.S. Department of Justice, Antitrust Division. I hold a B.A. degree in economics from the University of California, Santa Barbara, and I received my M.A. and Ph.D. degrees in economics from the University of Chicago. My resume, which contains more information on my background and qualifications, is contained in Appendix I.

5. Competition Economics LLC is being compensated at my standard hourly rate of \$575, and neither my compensation nor the compensation of Competition Economics LLC is contingent on the outcome of this proceeding. My research into the matters discussed in this report is ongoing, and I reserve the right to modify or supplement my opinions as additional information becomes available. I have been provided by counsel for Plaintiffs<sup>1</sup> with access to the entire record in this case. A detailed list of the materials and resources that I or staff operating under my direction relied upon in preparing this report is contained in Appendix II.

B. *Assignment*

6. I have been asked to determine if there exist well-accepted economic methodologies and common evidence from which a fact-finder could determine the existence of an agreement to rig ISDAfix rates, i.e., that Defendants<sup>2</sup> entered into a conspiracy to rig ISDAfix rates.

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<sup>1</sup> Plaintiffs comprise Alaska Electrical Pension Fund; Genesee County Employees' Retirement System; County of Montgomery, Pennsylvania; County of Washington, Pennsylvania; and City of New Britain, Connecticut; Erste Abwicklungsanstalt (EAA); Portigon AG; and the Pennsylvania Turnpike Commission.

<sup>2</sup> Defendants comprise the Defendant Banks and ICAP. Defendant Banks comprise Bank of America, N.A.; Barclays Bank PLC; BNP Paribas SA; Citigroup Inc.; Credit Suisse AG, New York Branch; Deutsche Bank AG; The Goldman Sachs Group, Inc.; HSBC Bank USA, N.A.; JPMorgan Chase & Co.; Morgan Stanley & Co. LLC; Nomura Securities International, Inc.; Royal Bank of Scotland PLC; UBS AG; and Wells Fargo Bank, N.A., as well as any of their respective divisions, business units, subsidiaries, affiliates, predecessors, successors-in-interest, and companies under their direct or indirect management or control, as well as any of their present and former agents, directors, officers, managers, analysts, accountants, attorneys, representatives, servants, employees, or other persons acting under their direction or control. ICAP means Defendant ICAP Capital Markets LLC and its divisions, business units, subsidiaries, indirect or direct parents, affiliates, predecessors, successors-in-interest, and companies under its direct or indirect management or control, as well as any of its present and former agents, directors, officers, managers, analysts,

C. *Overview of opinions*

7. This section summarizes my findings and conclusions to date. Because the report contains a detailed analysis, the following summary does not reflect all of my findings and conclusions or all of the bases for those findings and conclusions. The facts or data upon which I am basing the opinions and inferences discussed in this report are of a type reasonably relied upon by experts in the field of industrial organization.<sup>3</sup> My primary conclusions are summarized as follows:

*Well-accepted economic methodologies and common evidence can be used to determine whether Defendants rigged ISDAfix rates*

- Well-accepted economic methodologies and common evidence support the allegation that Defendants conspired to rig ISDAfix rates.
- Common evidence shows that Defendant Banks regularly rubber stamped the ICAP Reference Rate until late 2012. Such unanimous submissions, as well as their dissipation after late 2012, cannot be explained by market factors. Defendant Banks' rubber-stamped submissions were against their unilateral interests in the absence of an agreement. The ICAP Reference Rate served as a focal point for coordination among Defendant Banks with respect to their USD ISDAfix submissions, facilitating their ability to manipulate USD ISDAfix rates by banging the close without the need for direct communications on a daily basis.
- Defendant Banks' banging the close activities provide common evidence of actions against their self-interests but for the existence of an agreement.

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accountants, attorneys, representatives, servants, employees, or other persons acting under its direction or control or under whose direction and control it has acted, including, without limitation, ICAP PLC.

<sup>3</sup> The field of industrial organization has been defined as: "the study of the structure of firms and markets and of their interactions." Carlton, D. and Perloff, J. (2005), *Modern Industrial Organization*, 4<sup>th</sup> ed., Boston, MA: Pearson Addison-Wesley, p. 2. As one well-known textbook summarizes: "A focus and concern with market power underpins industrial organization. . . . What are the determinants of market power? How do firms create, utilize, and protect it? When are antitrust enforcement or regulation appropriate policy responses to the creation, maintenance, or exercise of market power?" Church, J. and Ware, R. (2000), *Industrial Organization: A Strategic Approach*, Boston, MA: Irwin McGraw-Hill, p. vii. For this reason, Industrial Organization textbooks contain extended analyses of antitrust issues. See, e.g., Carlton, D. and Perloff, J. (2005), *Modern Industrial Organization*, 4<sup>th</sup> ed., Boston, MA: Pearson Addison-Wesley, Chapters 4, 5, 11, and 19; Church, J. and Ware, R. (2000), *Industrial Organization: A Strategic Approach*, Boston, MA: Irwin McGraw-Hill, Chapters 1, 5, 6, 7, 10, 19, 20, 21, 22, and 23; and Belleflame, P. and Peitz, M. (2015), *Industrial Organization: Markets and Strategies*, Cambridge University Press, Chapters 14, 15, 16, and 17.

- Dr. Pirrong’s expert report demonstrates that, as a result of Defendants’ conduct, actual interest rates differed from but-for benchmark interest rates in the proposed Class Period.

*Market definition*

- There is a relevant product market for U.S. dollar (“USD”) denominated interest rate derivatives.
- The relevant geographic market is worldwide.

D. *Outline of report*

8. Section II summarizes Plaintiffs’ antitrust allegations. Section III presents my analysis of whether there exist well-accepted economic methodologies and common evidence from which a fact-finder could determine the existence of an agreement to rig ISDAfix rates, i.e., that Defendants entered into a conspiracy to rig ISDAfix rates. Section IV provides an analysis of the relevant antitrust market. Section V contains my conclusions.

II. PLAINTIFFS’ ANTITRUST ALLEGATIONS

9. Plaintiffs allege that Defendants conspired to use the USD ISDAfix rate-setting process to rig USD ISDAfix rates. (See the expert reports of Mr. Farrell<sup>4</sup> and Dr. Pirrong<sup>5</sup> for discussions of the ISDAfix rate-setting process.) Plaintiffs further allege that Defendant Banks manipulated the ICAP Reference Rate on a given day by manipulating the rates and spreads on the 19901 page and/or treasury rates on ICAP’s BrokerTec platform at 11:00 am.<sup>6</sup> ICAP then pre-populated each bank’s submission page with the ICAP Reference Rate, a process that was not disclosed publicly.<sup>7</sup> Defendants’ manipulation of the ICAP Reference Rate was fundamentally

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<sup>4</sup> Expert Report of Robert Farrell (July 28, 2017) (hereinafter “Farrell Expert Report”).

<sup>5</sup> Expert Report of Craig Pirrong, Ph. D. (July 28, 2017) (hereinafter “Pirrong Expert Report”).

<sup>6</sup> ISDA’s CEO during the Class Period, Robert Pickel, confirmed that “because of the connection between 19901 and ISDAFIX there was that potential” for manipulation. Deposition of Robert G. Pickel (June 7, 2017) (hereinafter “Pickel Deposition”), 206-207.

<sup>7</sup> See Deposition of Catherine Farrer (April 6, 2017) (hereinafter “Farrer Deposition”), 81:16-83:11; Pickel Deposition, 112:25-115:4.

premised on the banks' understanding that the other panel banks would rubber stamp the manipulated ICAP Reference Rates; for if several panel banks submitted independent rates, rather than rubber stamping the ICAP Reference Rate, the ICAP Reference Rate would not become the published, final USD ISDAfix rate. By manipulating the ICAP Reference Rate and then rubber stamping that rate, Defendants rigged the final ISDAfix rate that was published to unsuspecting investors.

### III. COMMON ECONOMIC EVIDENCE SUPPORTS THE EXISTENCE OF A CONSPIRACY

10. In this section, I examine whether Defendants' actions are consistent with coordinated behavior and inconsistent with competition. I consider whether the structure of the USD-denominated interest rate derivatives market is favorable to collusion,<sup>8</sup> and whether Defendants acted against their independent self-interests but for the existence of an agreement. I recognize that courts have utilized a number of "plus factors" in evaluating market conditions and defendant conduct. I understand that courts have used these plus factors because "unlawful conspiracies tend to form in secret, . . . proof will rarely consist of explicit agreements."<sup>9</sup> Rather, the presence or absence of conduct constituting collusion can be evaluated by examining "inferences that may fairly be drawn from the behavior of the alleged conspirators."<sup>10</sup>

11. Based on my analysis of the market structure and Defendants' conduct, I conclude that the particular structure of the USD ISDAfix rate-setting process allowed Defendants to rig ISDAfix rates. In particular, Defendant Banks rubber stamped the ICAP Reference Rate on almost

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<sup>8</sup> Empirical evidence shows that there exists a relevant antitrust market for USD-denominated interest rate derivatives in a worldwide geographic market. See Section IV.

<sup>9</sup> *In re Elec. Books Antitrust Litig.*, 859 F. Supp. 2d 671, 681 (S.D.N.Y. 2012), quoting *Anderson News, L.L.C. v. Am. Media, Inc.*, 680 F.3d 162, 183, No. 10-4591-cv, 2012 WL 1085948, at \*17 (2d Cir. Apr. 3, 2012), and *Monsanto Co. v. Spray-Rite Service Corp.*, 465 U.S. 752, 761, 104 S.Ct. 1464, 79 L.Ed.2d 775 (1984).

<sup>10</sup> *Id.*



every day until late 2012. Such unanimous submissions, as well as their dissipation after late 2012, cannot be explained by market factors. Defendant Banks' rubber-stamped submissions were not only against their unilateral interests in the absence of an agreement, but they breached the contributor agreements that each of the banks entered into with ISDA. The ICAP Reference Rate served as a focal point for coordination among Defendant Banks with respect to their USD ISDAfix submissions, facilitating their ability to manipulate ISDAfix by banging the close without extensive direct communications on a daily basis.

12. I also conclude that common economic evidence can be used to show that Defendants engaged in actions contrary to their independent self-interests but for the existence of an agreement. The *ABA Section of Antitrust Law* has discussed the importance of evaluating conduct against firms' self-interest:

Courts discuss conduct against self-interest as a plus factor and the fundamental principle underlying many other kinds of conduct to which the plus factor label is attributed. The basic concept behind this factor is that, if the defendants have engaged in conduct that would further the interests of a conspiracy but would be against each defendant's interest if it were acting separately, the actions taken by the defendants are circumstantial proof of conspiracy. Such evidence has been described as "perhaps the strongest plus factor indicative of a conspiracy."<sup>11</sup>

13. In the present case, Defendant Banks' banging the close activities provide common evidence of actions against their self-interests but for the existence of an agreement. Dr. Pirrong's expert report demonstrates that, as a result of Defendants' conduct, actual interest rates differed from but-for benchmark interest rates during the proposed Class Period.

14. Finally, after considering all the plus factors jointly, I conclude that there exist well-accepted economic methodologies and common evidence from which a fact-finder could

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<sup>11</sup> ABA Section of Antitrust Law (2010), *Proof of Conspiracy Under Federal Antitrust Laws*, pp. 69-70, quoting from *Merck-Medco Managed Care v. Rite Aid Corp.*, No. 98-2847, 1999 WL 691840, at \*10 (4<sup>th</sup> Cir. 1999).

determine the existence of an agreement to rig ISDAfix rates, i.e., that Defendants entered into a conspiracy to rig ISDAfix rates. The economic analysis of these actions, as well as the common evidence on which that analysis is based, does not depend on an individualized inquiry regarding any specific class member. Rather, both the economic analysis and the evidence on which it is based are common to the class.

A. *Defendant Banks' rubber-stamped submissions provided common evidence of actions against their self-interest and facilitated their ability to manipulate ISDAfix by banging the close without extensive direct communications*

i. *Defendants rubber stamped the ICAP Reference Rate*

15. ISDAfix is a benchmark used to settle a range of interest rate derivatives, including options on interest rate swaps known as swaptions.<sup>12</sup> ISDA claimed in its reports to the International Organization of Securities Commissions and the European Commission, as well as on its website, that ISDAFIX [REDACTED]

[REDACTED]<sup>13</sup>

16. Plaintiffs allege that Defendants “rubber stamped” the ICAP Reference Rate in their USD ISDAfix submissions in lockstep throughout the Class Period. In this section, I examine how rubber stamping works and how successful Defendants were in converting manipulated ICAP Reference Rates into collusive final ISDAfix rates. I analyze the economic evidence and demonstrate that the practice of rubber stamping the ICAP Reference Rate was pervasive throughout the Class Period. I also demonstrate that Defendant Banks’ submission pattern changed in late 2012 when the industry came under regulatory scrutiny, thus creating a structural break in Defendants’ conspiracy.

<sup>12</sup> See Farrell Expert Report, ¶ 240. See also BNPP\_AK\_00232438-82, at 53-71.

<sup>13</sup> MS-ALASKA01712320-21, at 20 (ISDA email to IOSCO); BNPP\_AK\_00000979-92, at 79 (ISDA submission to European Commission); ICM-001490659-78, at 60 (ISDA webpage).

17. The data demonstrate that Defendant Banks rubber stamped the ICAP Reference Rate in their ISDAfix submissions. Indeed, Defendant Banks rubber stamped the ICAP Reference Rate in their submissions almost every day prior to late 2012, when their submissions first began to diverge. As shown in Figure 1, during the years 2006-2012, Defendant Banks rubber stamped the ICAP Reference Rate in 216,737 out of 236,448 (or 92%) of their ISDAfix submissions; only 19,711 out of 236,448 (or 8%) of their ISDAfix submissions differed from the ICAP Reference Rate.<sup>14</sup> In contrast, in 2013, only 17,799 out of 28,536 (or 62%) of Defendant Banks' submissions equaled the ICAP Reference Rate; 10,737 out of 28,536 (or 38%) of their ISDAfix submissions differed from the ICAP Reference Rate.

18. The same pattern persists when examined across time for individual tenors. As shown in Figures 2-8, Defendant Banks rubber stamped the ICAP Reference Rates, i.e., accepted the ICAP Reference Rates as their own submissions, more than 90% of the time across all tenors prior to late 2012.<sup>15</sup> Beginning in late 2012, Defendant Banks' submissions started to diverge from the ICAP Reference Rate for all tenors.

19. Similarly, Table 1 shows that Defendant Banks rubber stamped the ICAP Reference Rates in approximately 84% of their submissions across all tenors in 2006 and 2007. In 2008, several non-Defendant banks (ABN AMRO Bank, Bear Stearns, and Lehman Brothers) dropped

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<sup>14</sup> These numbers exclude the 1-year tenor. According to ICAP:

[REDACTED] ("ICM's Responses to Technical Data Questions," provided by Counsel for ICAP to Counsel for Plaintiffs, at p. 3 (June 5 & 21, 2017)). ICAP did not make it available to me the data for the 1-year ICAP reference rate. See *id.* at p. 4.

[REDACTED] I have data for Defendant Banks' submissions and the final ISDAfix rate for the 1-year tenor. The relevant information are presented in Figure 9, Tables 3 and 4, and Figures A18 and A24.

<sup>15</sup> The results for other tenors are similar. See Figures A1-A5 in Appendix III. The 1-year tenor is excluded. See discussions in footnote 14.

out of the USD ISDAfix submission panel.<sup>16</sup> In response, ISDA and ICAP [REDACTED]

[REDACTED]

[REDACTED]

<sup>17</sup> This consolidation of the ISDAfix submission panel coincides with the percentage of daily bank submissions identical to the ICAP Reference Rate increasing to over 90% starting in 2008. After exceeding 90% in the five years from 2008 to 2012, Defendant Banks' rubber stamping dropped on average to approximately 60% in 2013. Put another way, while Defendant Banks's submissions differed from the ICAP Reference Rate approximately 8% of the time prior to 2013, that percentage increased almost five fold to approximately 38% in 2013 (see Table 2).

20. Defendant Banks' rubber-stamped submissions in 2006 through late 2012, as well as the sharp drop in the percentage of banks rubber stamping the ICAP Reference Rate beginning in late 2012, cannot be explained by changes in variations in market rates around 11 am. I use the average of the semi bond bid and ask rates from the 19901 Screen tick data produced by ICAP as the market rate.<sup>18</sup> I measure variations in market rates using a standard statistic, namely, the coefficient of variation ("CV"), hereafter "measure of dispersion."<sup>19</sup> As shown in Figures 2-8, as the percentage of banks rubber stamping the ICAP Reference Rate dropped sharply beginning in

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<sup>16</sup> See ICM-001536084, ICM-001536085, and ICM-000214851.

<sup>17</sup> ICM-001521066-67, at 66.

<sup>18</sup> I note that the semi bond bid and ask rates from the 19901 Screen may have been affected by Defendant Banks' banging the close activities.

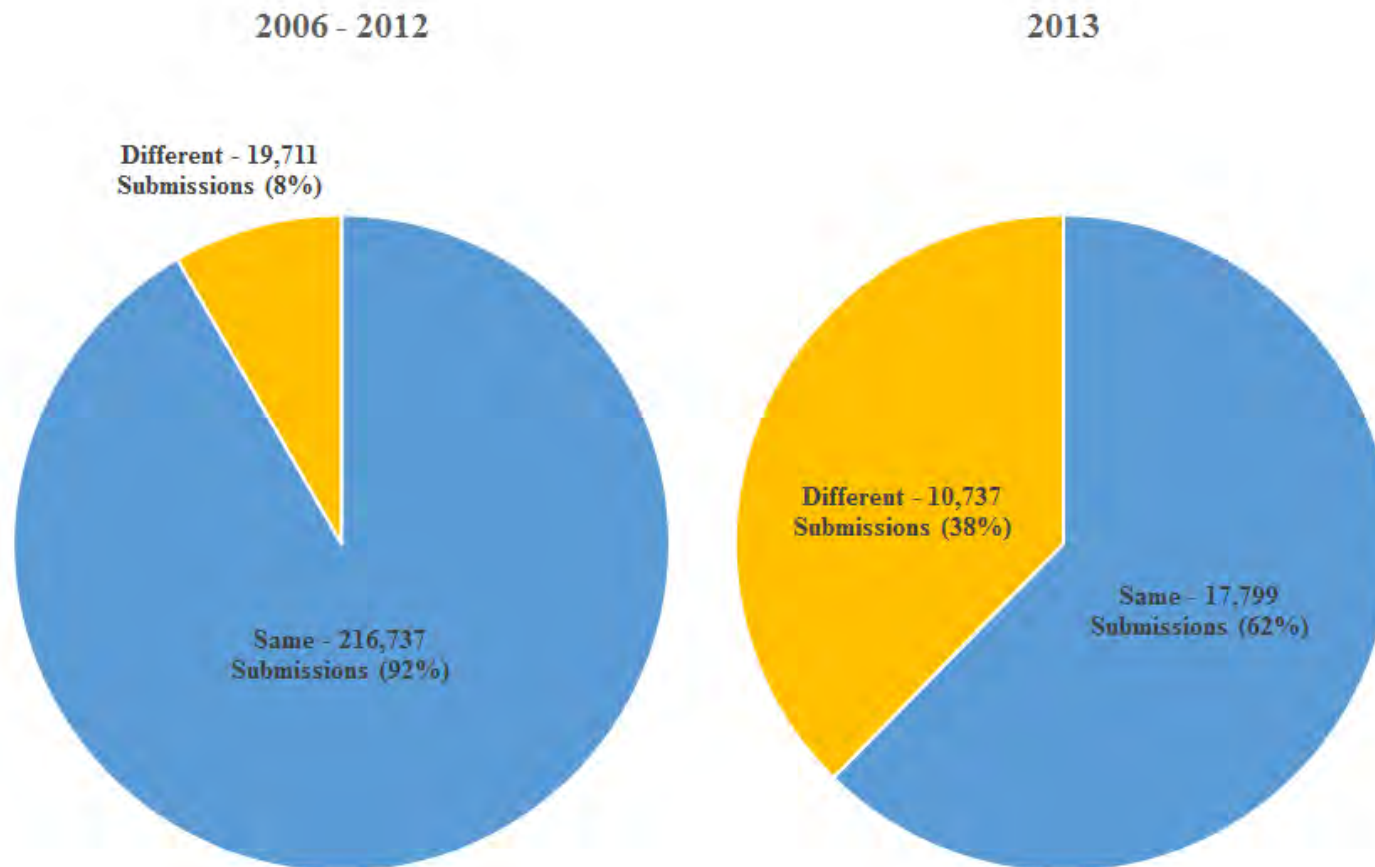
<sup>19</sup> The coefficient of variation of a sample of observations is defined as the ratio of the standard deviation over the mean of the sample. The coefficient of variation measures the amount of variability relative to the mean so that samples with different means can be compared.

late 2012, variations in market rates between 11:00:00 am and 11:01:59 am generally stayed at the same level across years for all tenors.<sup>20</sup>

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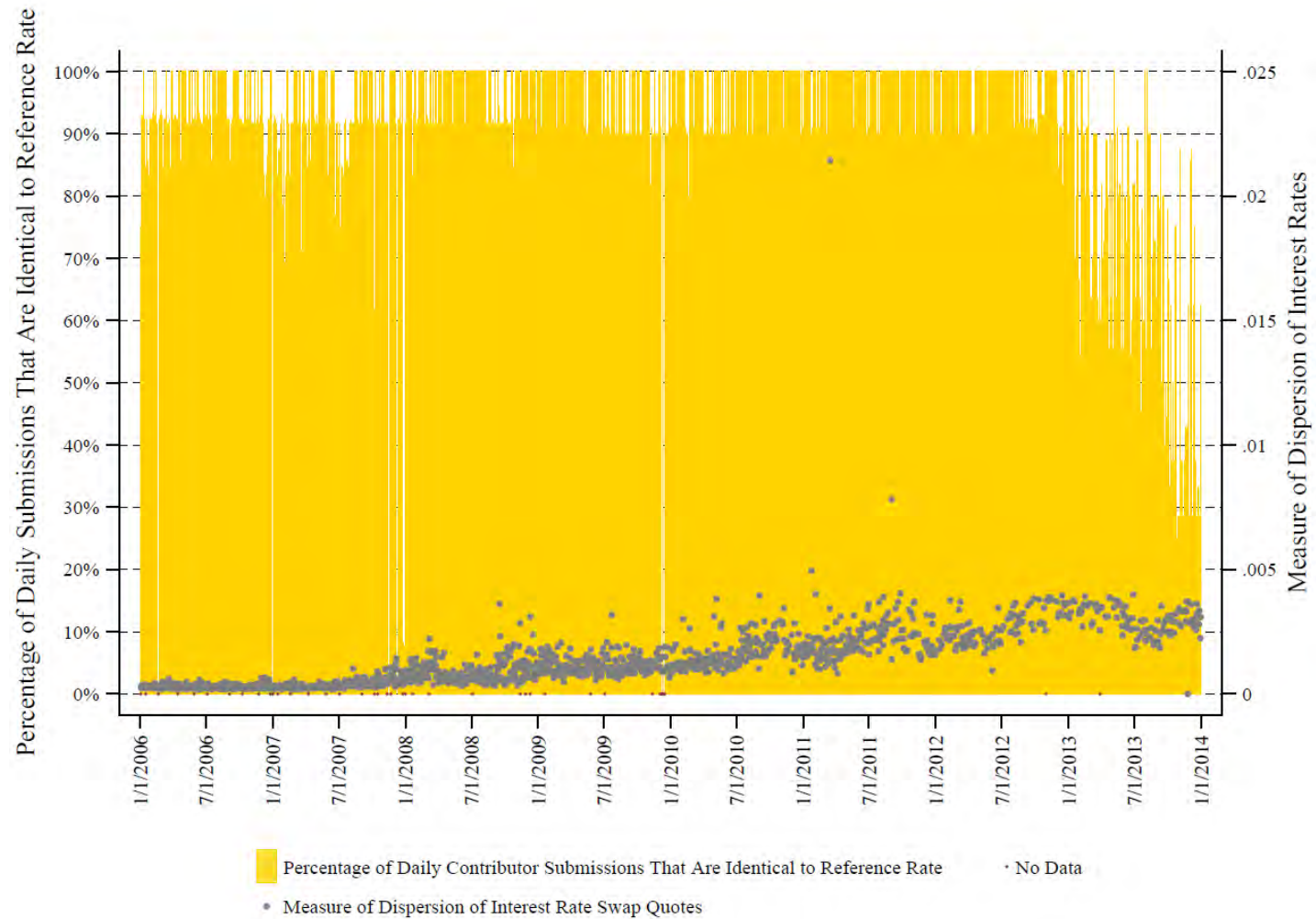
<sup>20</sup> As robustness check, rather than using the measure of dispersion of market rates on Screen 19901 between 11:00:00 am and 11:01:59 am, I use the measure of dispersion of market rates on Screen 19901 between 10:58:00 am and 11:01:59 am (see Figures A6-A17 in Appendix III). I further examine the relationship between variations in submissions and variations in market rates in Section III.A.ii. See the discussion regarding Figure 18.

FIGURE 1  
PERCENTAGE AND NUMBER OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE



Source: ICAP production data.

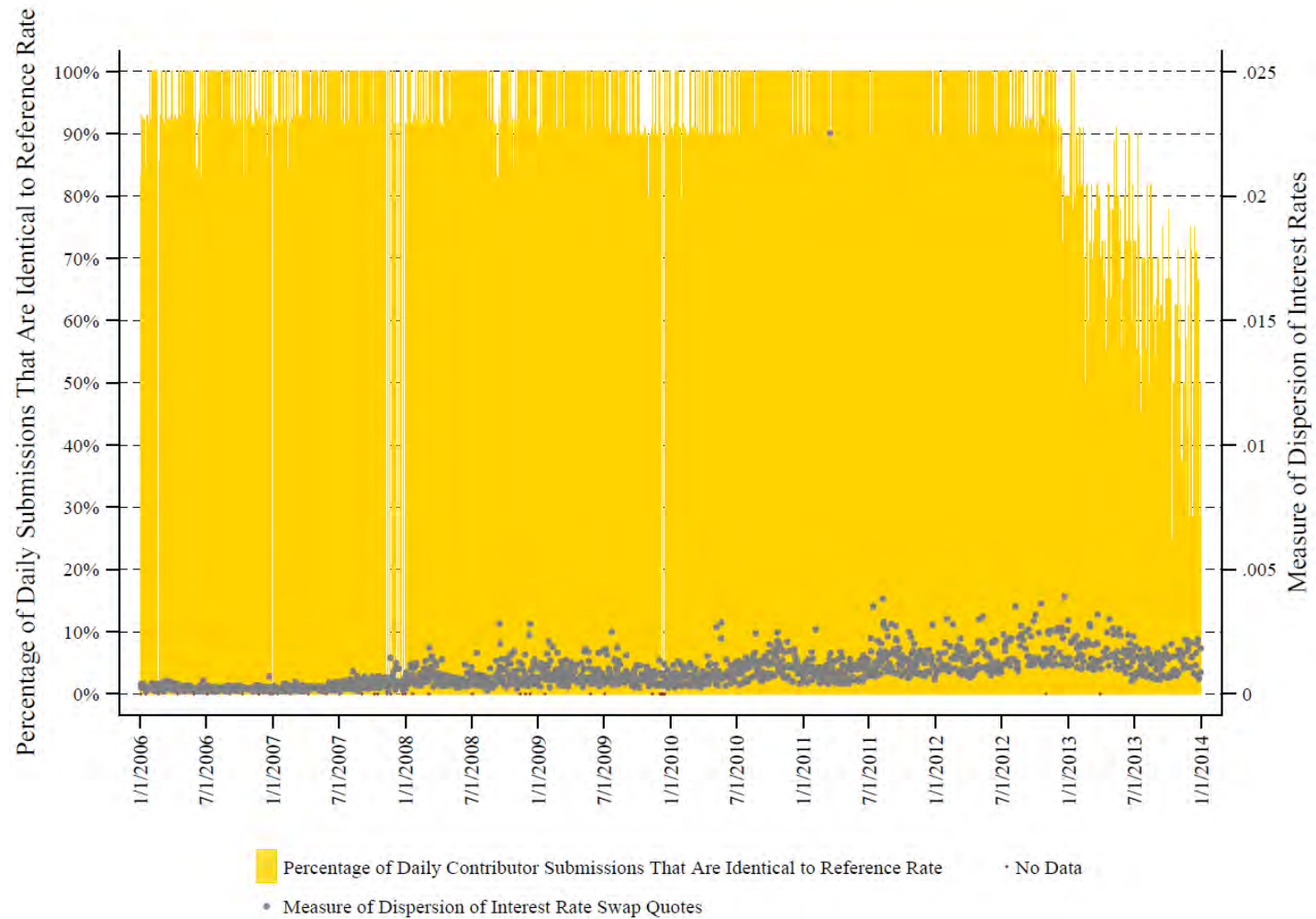
FIGURE 2  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 2-YEAR TENOR



Source: ICAP production data.



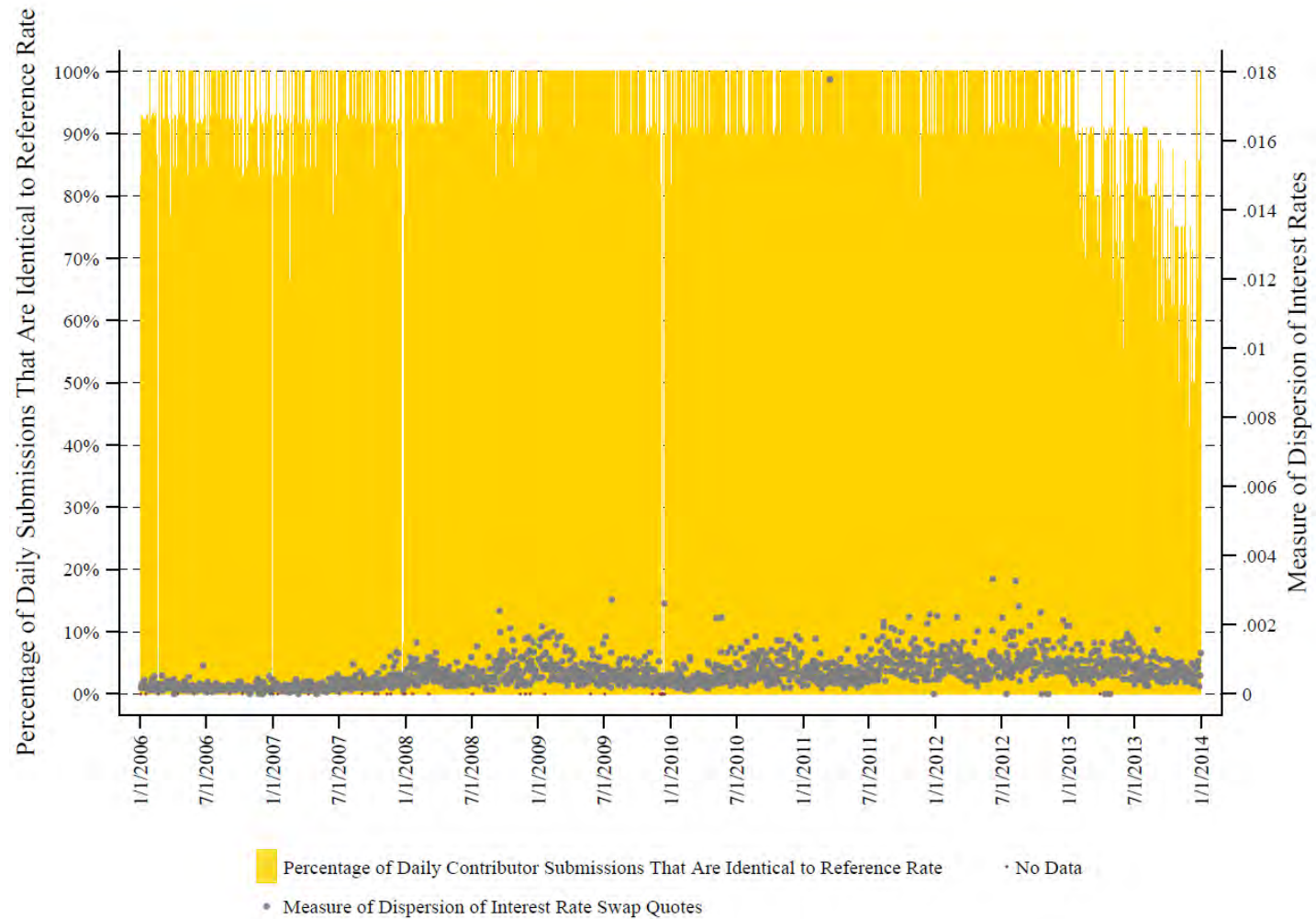
FIGURE 3  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 3-YEAR TENOR



Source: ICAP production data.

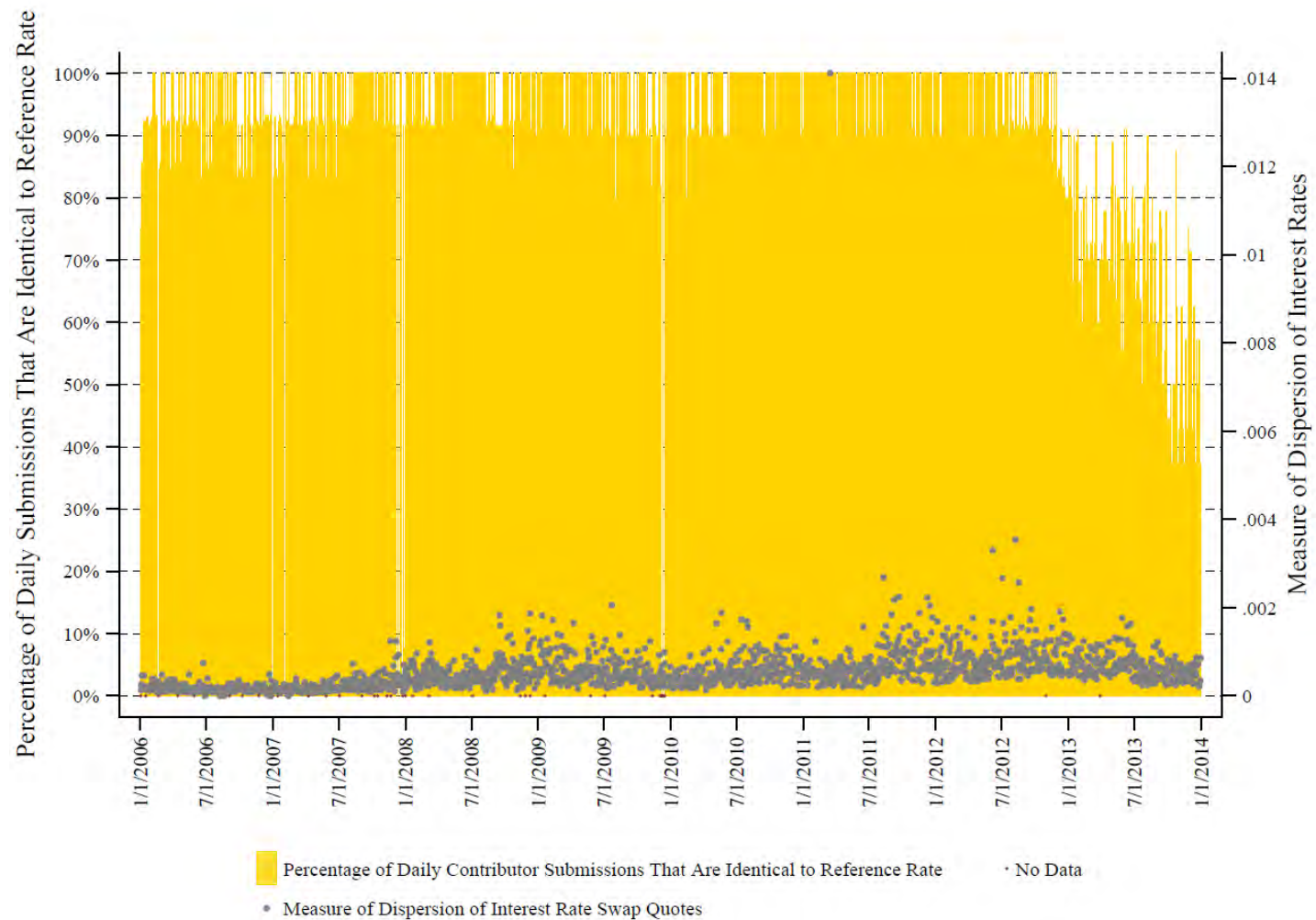


FIGURE 4  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 5-YEAR TENOR



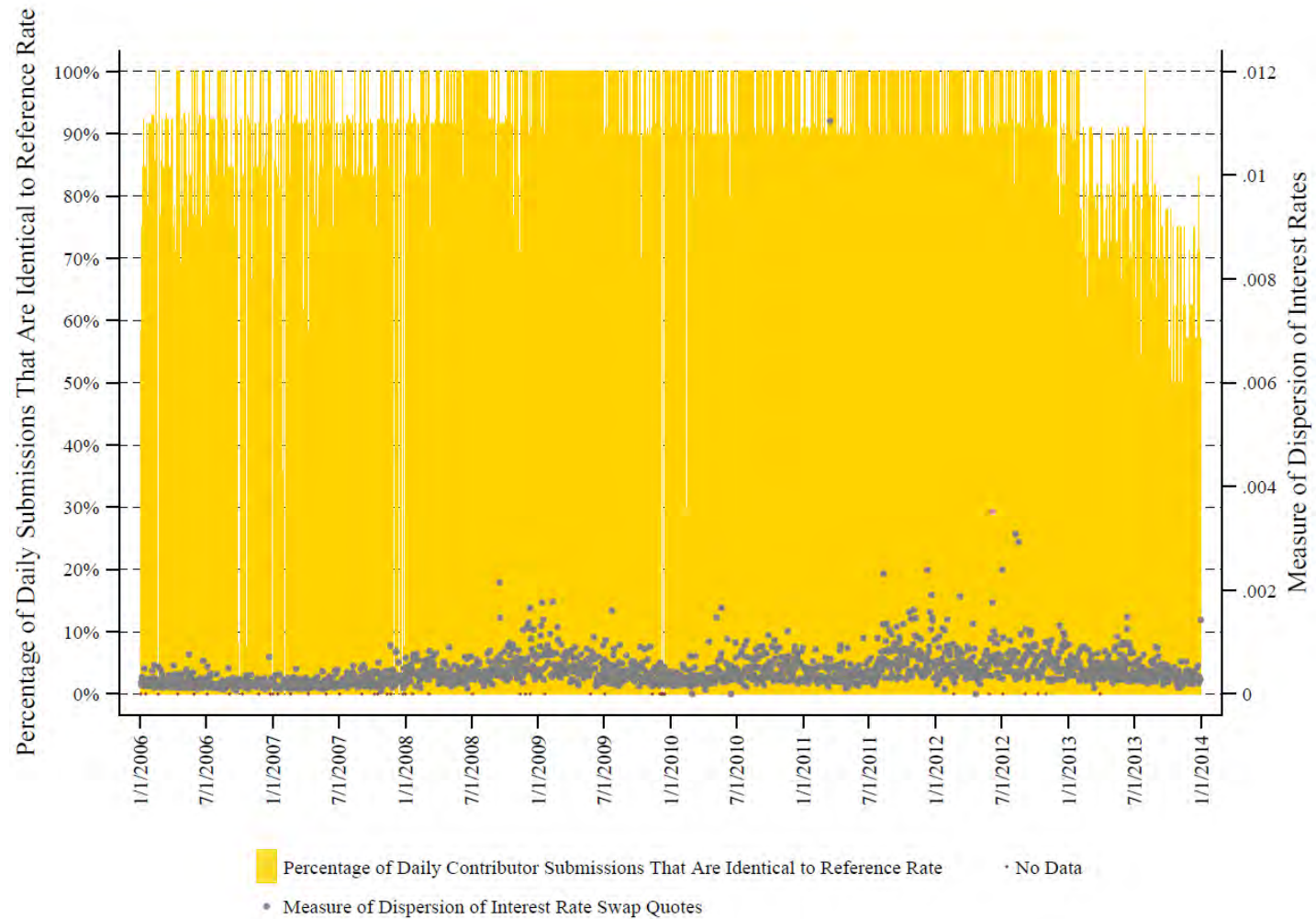
Source: ICAP production data.

FIGURE 5  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 7-YEAR TENOR



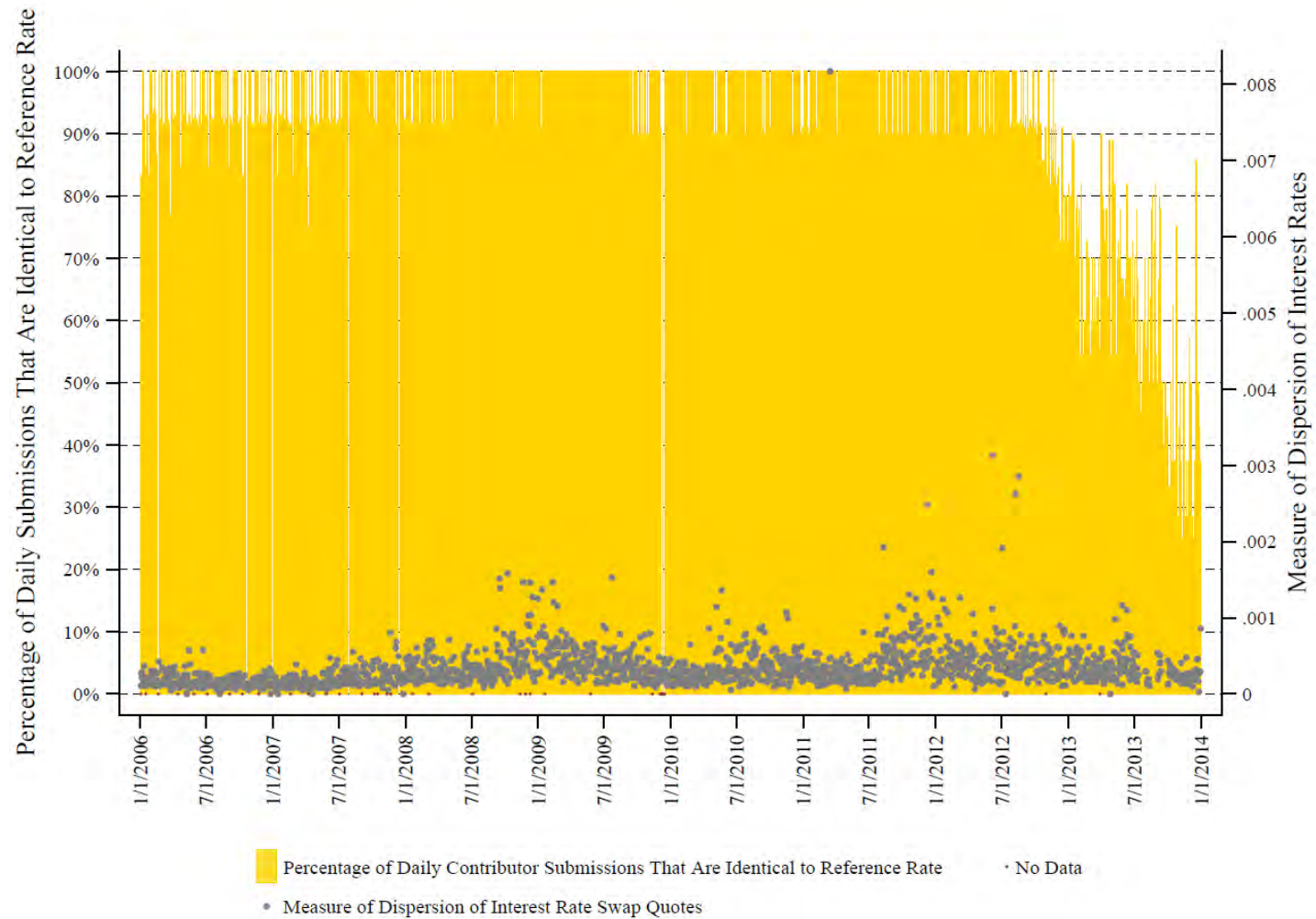
Source: ICAP production data.

FIGURE 6  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 10-YEAR TENOR



Source: ICAP production data.

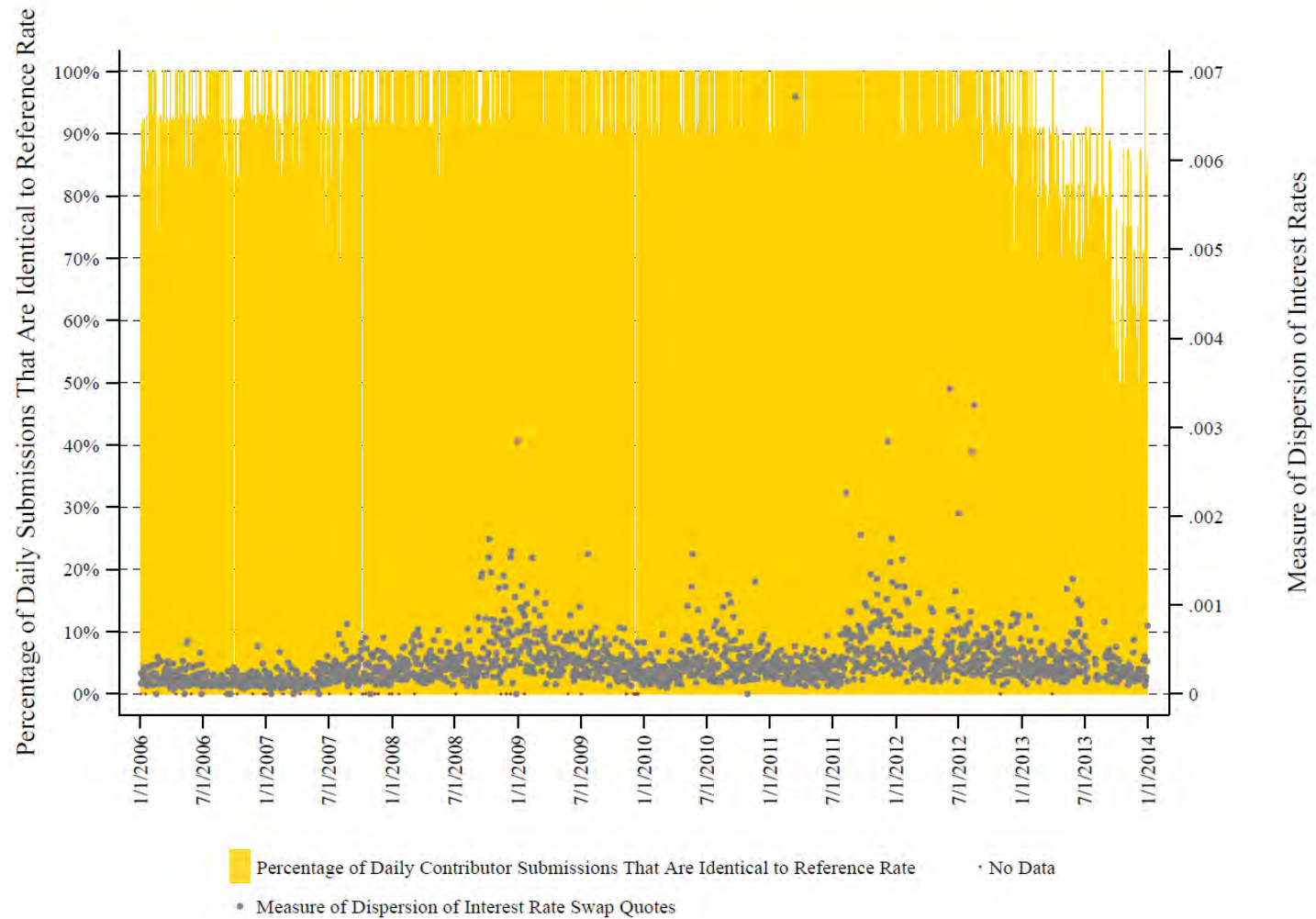
FIGURE 7  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 20-YEAR TENOR



Source: ICAP production data.



FIGURE 8  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 30-YEAR TENOR



Source: ICAP production data.

TABLE 1: PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE

<b>Tenor<sup>1</sup></b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
USD2Y	86%	80%	94%	94%	94%	97%	95%	62%
USD3Y	91%	83%	95%	94%	94%	98%	94%	61%
USD4Y	89%	80%	96%	93%	93%	96%	92%	60%
USD5Y	87%	83%	95%	96%	95%	96%	95%	73%
USD6Y	87%	83%	98%	97%	97%	97%	92%	55%
USD7Y	87%	84%	96%	94%	95%	97%	93%	59%
USD8Y	86%	83%	98%	98%	97%	96%	91%	55%
USD9Y	85%	84%	98%	98%	96%	96%	91%	56%
USD10Y	77%	76%	91%	95%	93%	95%	93%	70%
USD15Y	85%	86%	98%	98%	96%	96%	91%	56%
USD20Y	87%	85%	98%	98%	96%	97%	92%	55%
USD30Y	88%	79%	95%	96%	95%	98%	95%	73%

**Source:**

ICAP production data.

**Notes:**

<sup>1</sup> For each tenor, I calculate the percentage of banks that rubber stamped the ICAP Reference Rate on each day. I then calculate the averages across days in each year.

TABLE 2: PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS THAT DIFFER FROM THE ICAP REFERENCE RATE

<b>Tenor<sup>/1</sup></b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
USD2Y	14%	20%	6%	6%	6%	3%	5%	38%
USD3Y	9%	17%	5%	6%	6%	2%	6%	39%
USD4Y	11%	20%	4%	7%	7%	4%	8%	40%
USD5Y	13%	17%	5%	4%	5%	4%	5%	27%
USD6Y	13%	17%	2%	3%	3%	3%	8%	45%
USD7Y	13%	16%	4%	6%	5%	3%	7%	41%
USD8Y	14%	17%	2%	2%	3%	4%	9%	45%
USD9Y	15%	16%	2%	2%	4%	4%	9%	44%
USD10Y	23%	24%	9%	5%	7%	5%	7%	30%
USD15Y	15%	14%	2%	2%	4%	4%	9%	44%
USD20Y	13%	15%	2%	2%	4%	3%	8%	45%
USD30Y	12%	21%	5%	4%	5%	2%	5%	27%

**Source:**

ICAP production data.

**Notes:**

<sup>/1</sup> For each tenor, I calculate the percentage of banks that submitted a rate that differed from the ICAP Reference Rate on each day. I then calculate the averages across days in each year.

21. Since Defendant Banks generally rubber stamped the ICAP Reference Rate during the alleged collusive period, their common ISDAfix submissions became the final ISDAfix rate almost every day prior to late 2012. As shown in Figure 9, in the years 2006-2012, Defendant Banks' collectively made 257,579 ISDAfix submissions. Defendant Banks' submissions matched the final ISDAfix rates in 240,153 (or 93%) instances. In other words, Defendant Banks submitted rates that differed from the final ISDAfix rates only 17,426 out of 257,579 (or 7%) times.

22. In contrast, in 2013-2014, Defendant Banks' were just as likely to make submissions that differed from the final ISDAfix rate as not. As shown in Figure 9, Defendant Banks' collectively made 39,923 ISDAfix submissions in the 2013-2014 period. Their submissions matched the final ISDAfix rates in 19,698 (or 49%) instances. Thus, Defendant Banks submitted rates that differed from the final ISDAfix rates 20,225 out of 39,923 (or 51%) times.

23. The same pattern persists when examined across time for each tenor. Figures 10-16 show that more than 90% of Defendant Banks' submissions for all the tenors equaled the final ISDAfix rate prior to late 2012.<sup>21</sup> Beginning in late 2012, the percentage of Defendant Banks' submissions that equaled the final ISDAfix rate dropped significantly.

24. Similarly, Table 3 shows that approximately 90% of Defendant Banks' submissions matched the final ISDAfix rate in the prior seven years, but in 2013 and 2014, less than 50% of Defendant Banks' submissions became the final ISDAfix rate. Put another way, while Defendant Banks' submissions differed from the final ISDAfix rate approximately 7% of the time prior to 2013, that percentage increased more than seven fold to approximately 51% in 2013 and 2014 (see Table 4).

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<sup>21</sup> I note that in the period January 2014 – July 2014, ICAP was removed from the ISDAfix rate-setting process, and ICE did not take over the ISDAfix rate-setting process until August 2014. Thomson Reuters was in charge of the ISDAfix rate-setting process in this period, and I understand that banks' ISDAfix submission data for that period are not available. The results for other tenors are similar. See Figures A18-A23 in Appendix III.



25. Variations in market rates between 11:00:00 am and 11:01:59 am, however, generally stayed at the same level across years for all tenors, as indicated by the generally stable values of the measure of dispersion of market rates.<sup>22</sup> Thus, Defendant Banks' rubber-stamped submissions cannot be explained by changes in variations of market rates around 11 am.

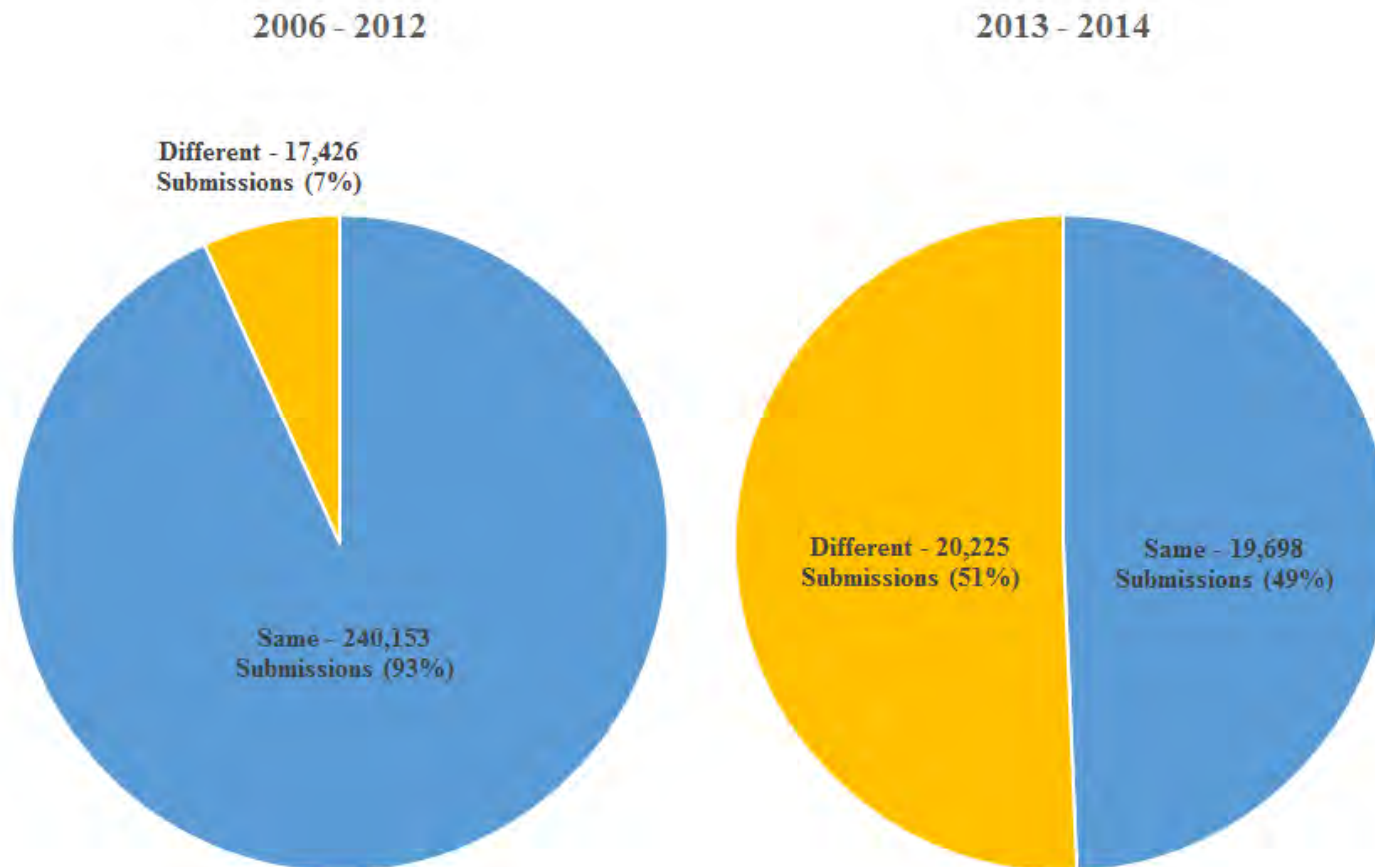
26. As shown in Figures 10-16, on almost every day for several years, Defendant Banks submitted the exact same rate, down to three decimal points (or one tenth of a basis point), representing that they would themselves unilaterally offer and bid a swap at the exact same rate. Importantly, this unanimous submissions pattern dissipated in late 2012.

27. From an economic perspective, it is impossible without coordination that Defendant Banks would have all submitted the exact same rate, down to three decimal points (or one tenth of a basis point), across all tenors on more than 90 percent of the days in the nearly seven years from 2006 through late 2012. The impossibility of this observed conduct is demonstrated by a comparison of Defendants Banks' submissions during the 2006 through late 2012 period versus those made after late 2012, as reflected in Figures 10-16.

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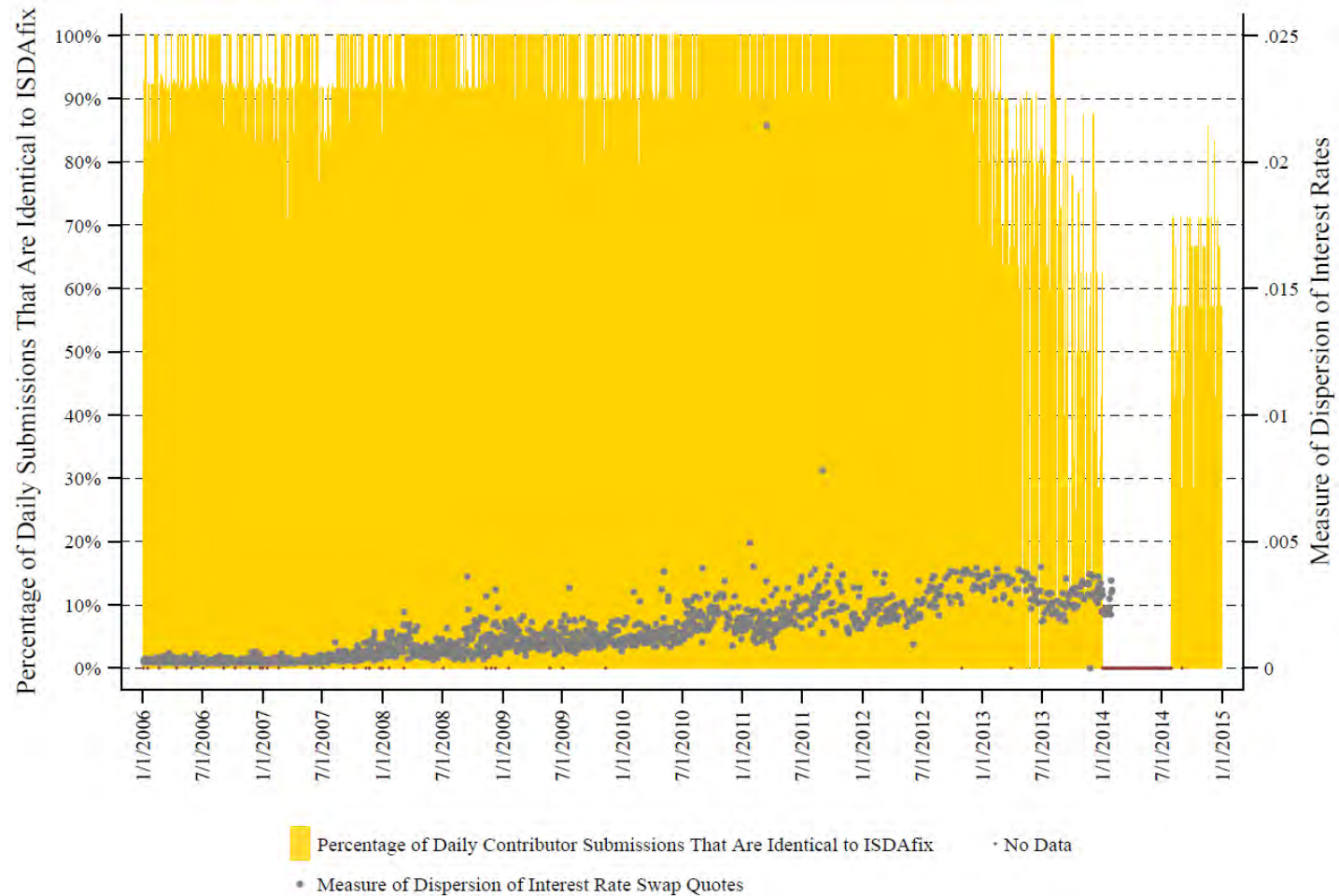
<sup>22</sup> ICAP did not provide market rate data for the 1-year tenor. As ICAP explained concerning the 1-year rates: [REDACTED] ("ICM's Responses to Technical Data Questions," provided by Counsel for ICAP to Counsel for Plaintiffs, at p. 3 (June 5 & 21, 2017)). As robustness check, rather than using the measure of dispersion of market rates on Screen 19901 between 11:00:00 am and 11:01:59 am, I use the measure of dispersion of market rates on Screen 19901 between 10:58:00 am and 11:01:59 am (see Figures A24-A36 in Appendix III).

FIGURE 9  
PERCENTAGE AND NUMBER OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE



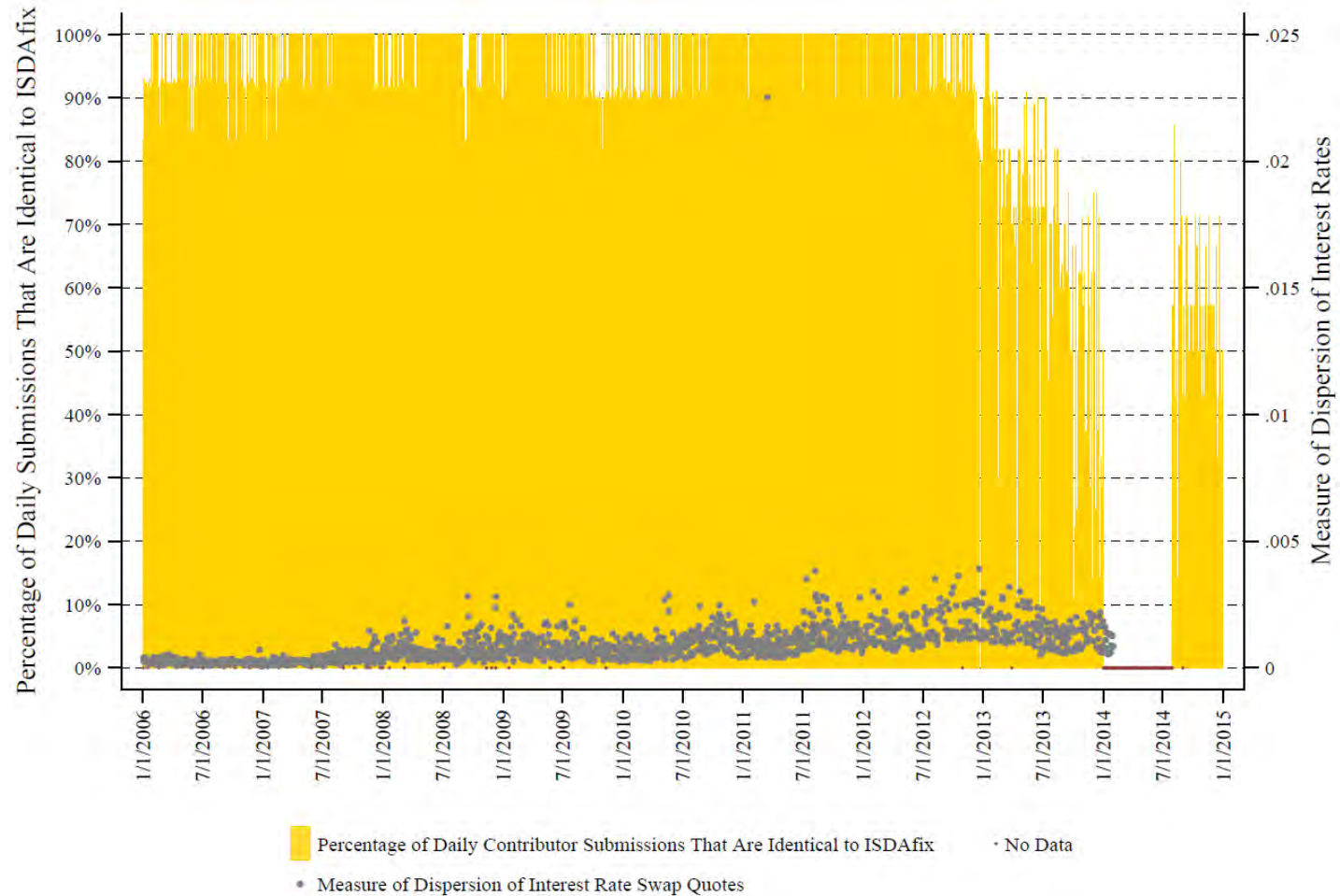
Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

FIGURE 10  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 2-YEAR TENOR



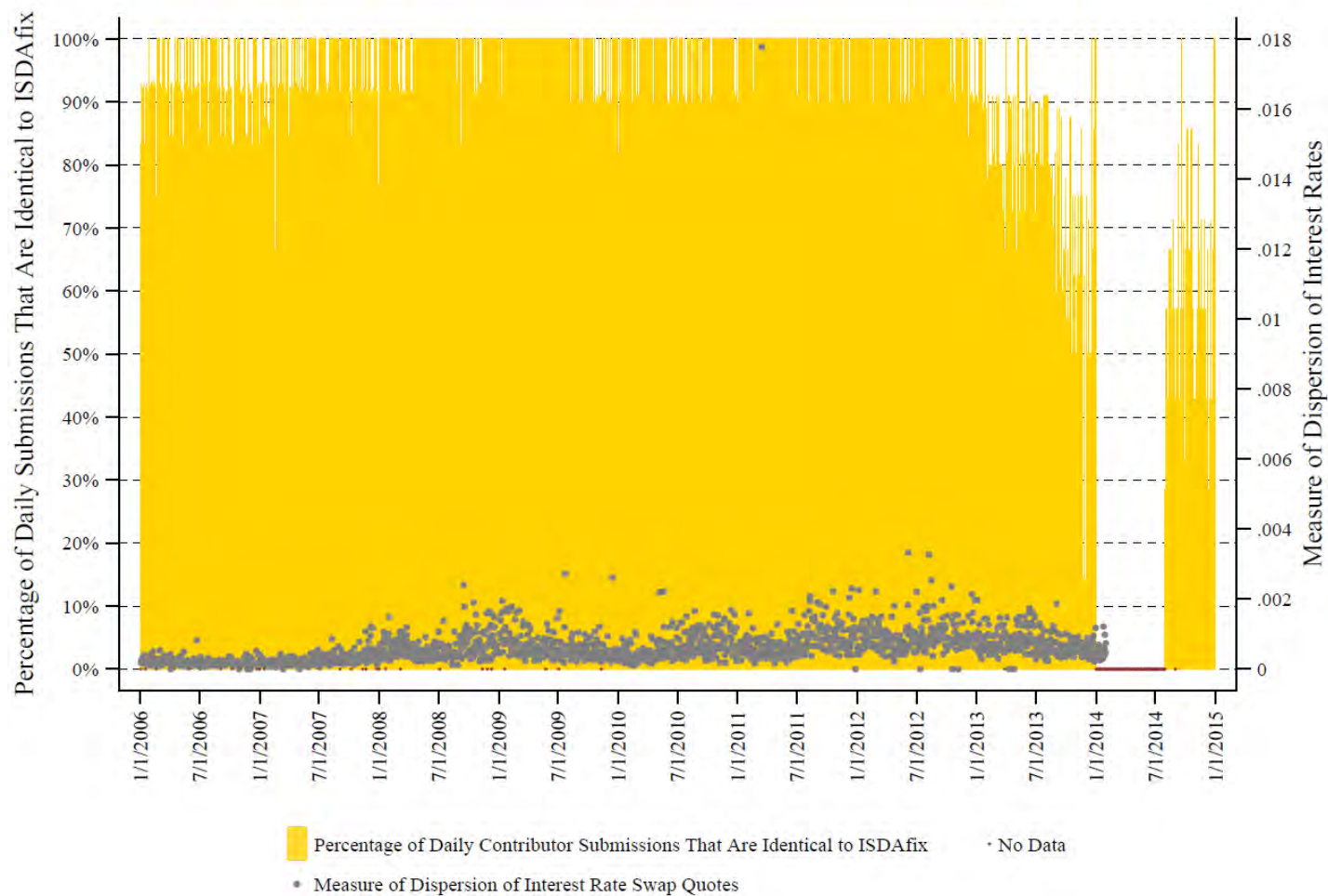
Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

FIGURE 11  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 3-YEAR TENOR



Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

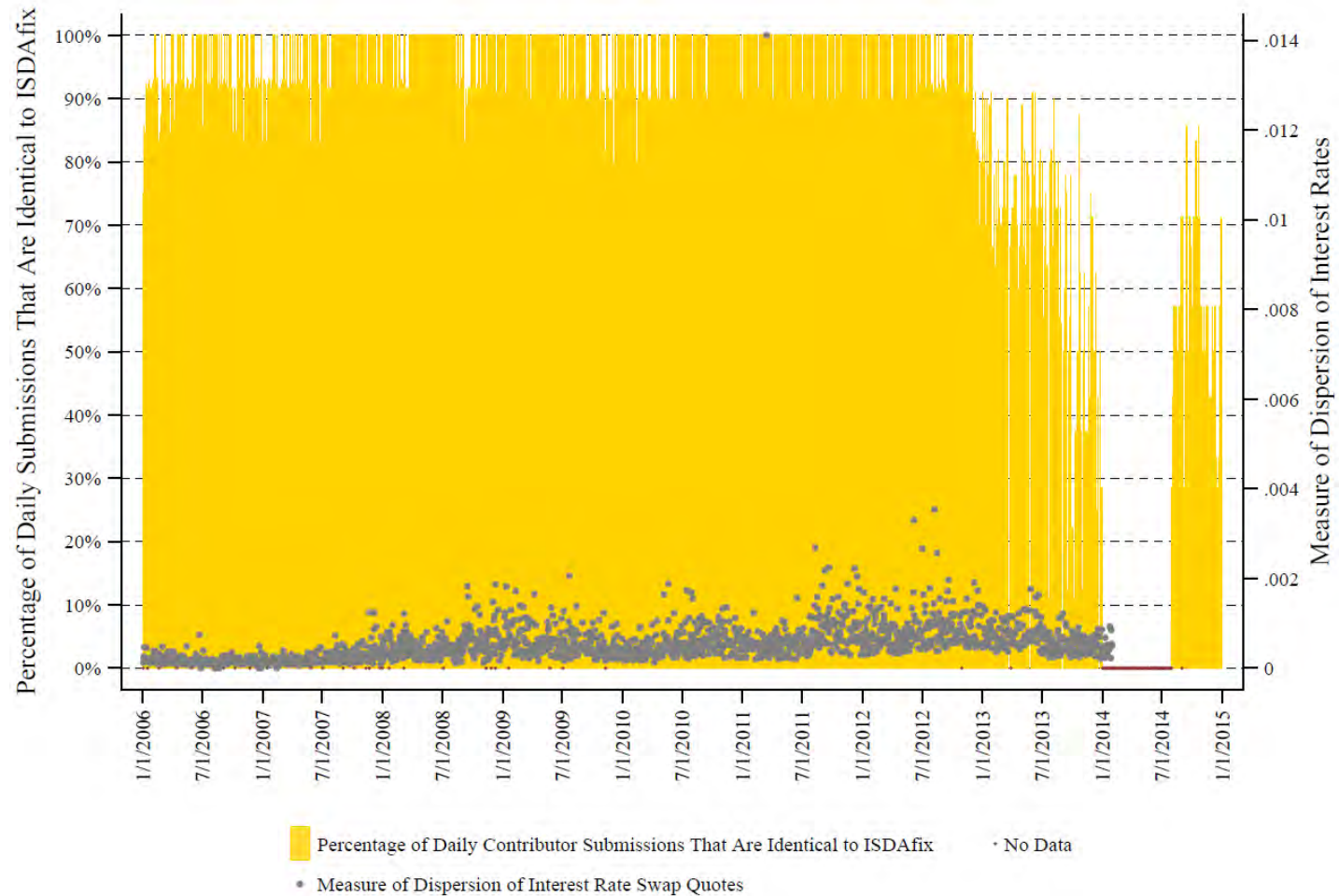
FIGURE 12  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 5-YEAR TENOR



Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

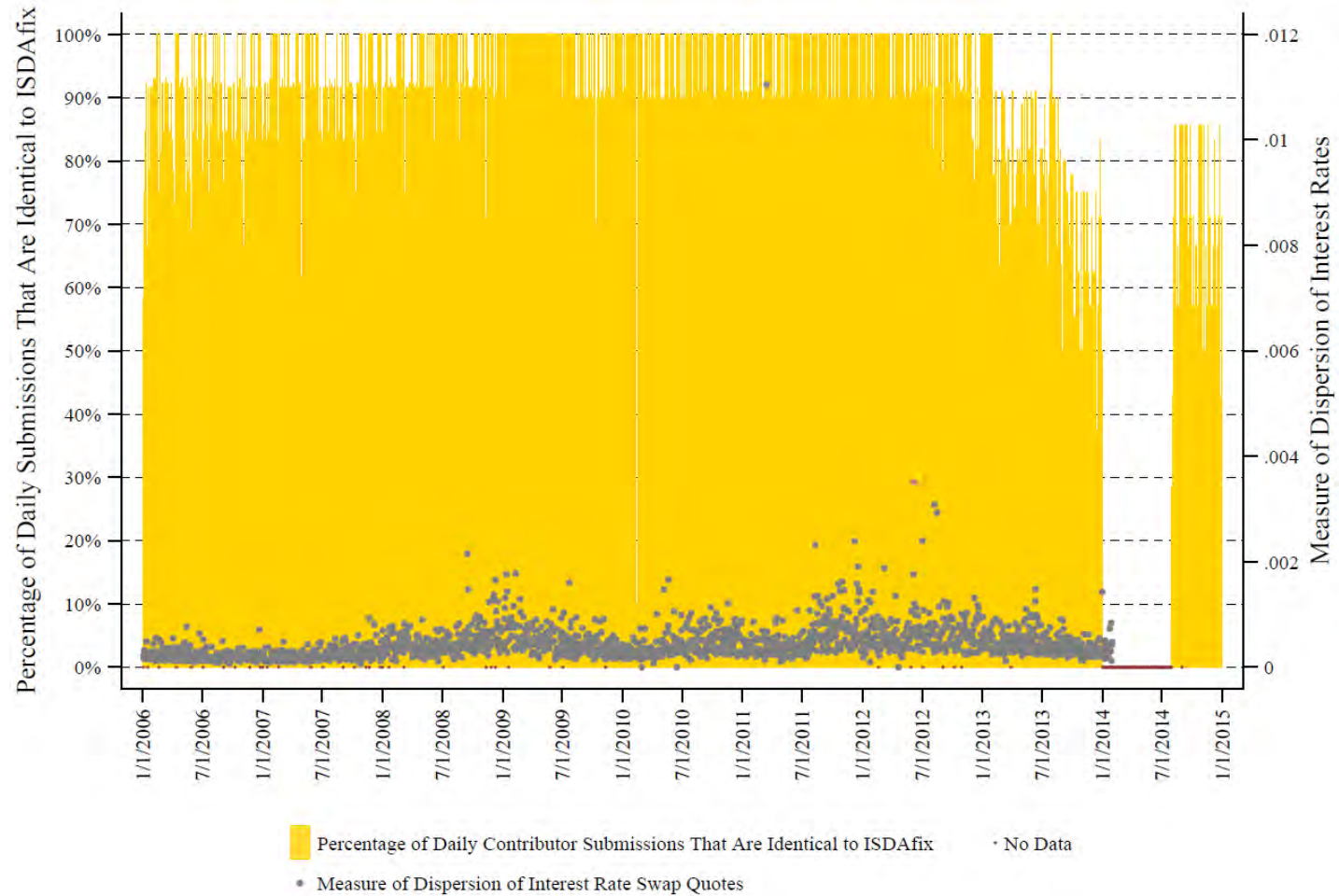


FIGURE 13  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 7-YEAR TENOR



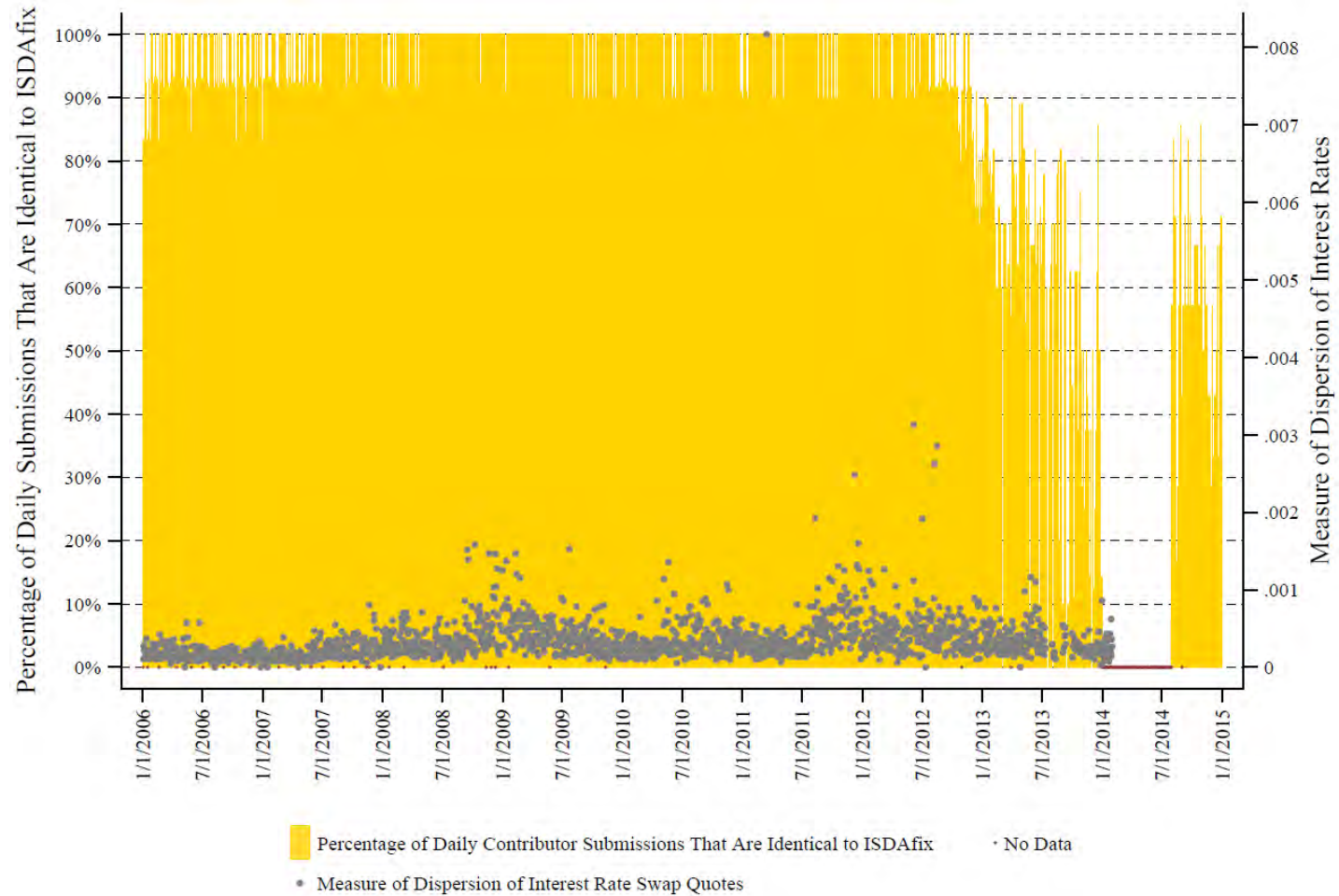
Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

FIGURE 14  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 10-YEAR TENOR



Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

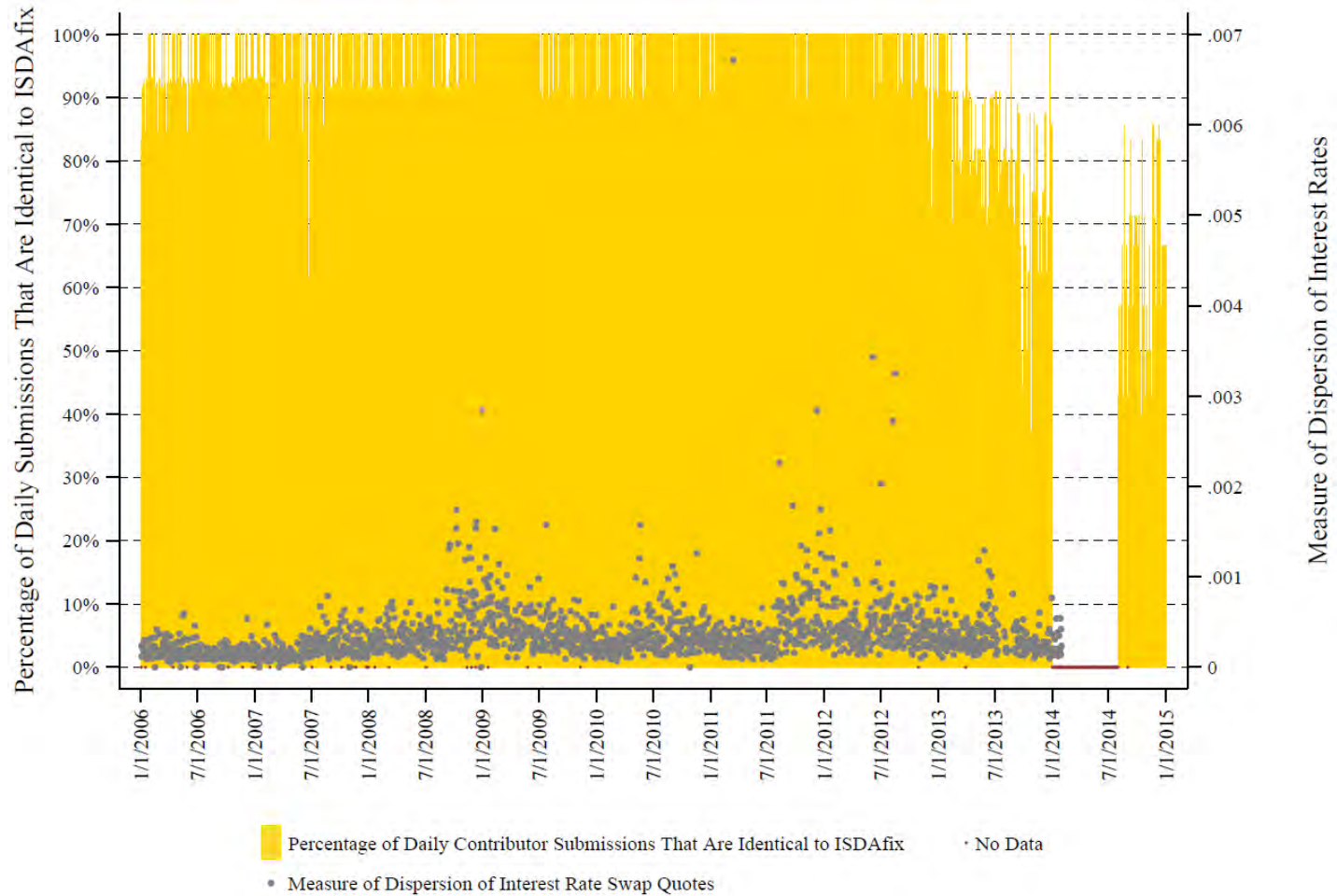
FIGURE 15  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 20-YEAR TENOR



Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.



FIGURE 16  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 30-YEAR TENOR



Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

TABLE 3: PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE

Tenor <sup>/1</sup>	2006	2007	2008	2009	2010	2011	2012	2013	2014 <sup>/2</sup>
USD1Y	87%	89%	96%	96%	94%	94%	91%	57%	41%
USD2Y	87%	89%	94%	94%	93%	97%	95%	48%	50%
USD3Y	90%	94%	96%	94%	94%	98%	92%	48%	44%
USD4Y	89%	93%	96%	93%	92%	96%	91%	45%	42%
USD5Y	88%	91%	96%	96%	94%	96%	95%	69%	48%
USD6Y	89%	93%	98%	98%	96%	97%	91%	40%	42%
USD7Y	88%	93%	96%	95%	94%	97%	91%	44%	43%
USD8Y	88%	93%	98%	98%	96%	96%	89%	39%	44%
USD9Y	88%	93%	98%	98%	96%	96%	88%	40%	46%
USD10Y	80%	84%	92%	94%	92%	95%	93%	67%	54%
USD15Y	90%	93%	98%	98%	96%	96%	90%	41%	42%
USD20Y	91%	94%	98%	98%	96%	97%	91%	39%	46%
USD30Y	88%	92%	95%	96%	95%	98%	94%	70%	48%

**Source:**

ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

**Notes:**

<sup>/1</sup> For each tenor, I calculate the percentage of banks' submissions that matched the final ISDAfix rate on each day. I then calculate the averages across days in each year.

<sup>/2</sup> Results for 2014 only include the period August 1, 2014 through December 31, 2014. In the period January 2014 – July 2014, ICAP was removed from the ISDAfix rate-setting process, and ICE did not take over the ISDAfix rate-setting process until August 2014. Thomson Reuters was in charge of the ISDAfix rate-setting process in this period, and I understand that banks' ISDAfix submission data for that period are not available.

TABLE 4: PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS THAT DIFFER FROM THE FINAL ISDAFIX RATE

Tenor <sup>/1</sup>	2006	2007	2008	2009	2010	2011	2012	2013	2014 <sup>/2</sup>
USD1Y	13%	11%	4%	4%	6%	6%	9%	43%	59%
USD2Y	13%	11%	6%	6%	7%	3%	5%	52%	50%
USD3Y	10%	6%	4%	6%	6%	2%	8%	52%	56%
USD4Y	11%	7%	4%	7%	8%	4%	9%	55%	58%
USD5Y	12%	9%	4%	4%	6%	4%	5%	31%	52%
USD6Y	11%	7%	2%	2%	4%	3%	9%	60%	58%
USD7Y	12%	7%	4%	5%	6%	3%	9%	56%	57%
USD8Y	12%	7%	2%	2%	4%	4%	11%	61%	56%
USD9Y	12%	7%	2%	2%	4%	4%	12%	60%	54%
USD10Y	20%	16%	8%	6%	8%	5%	7%	33%	46%
USD15Y	10%	7%	2%	2%	4%	4%	10%	59%	58%
USD20Y	9%	6%	2%	2%	4%	3%	9%	61%	54%
USD30Y	12%	8%	5%	4%	5%	2%	6%	30%	52%

**Source:**

ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

**Notes:**

<sup>/1</sup> For each tenor, I calculate the percentage of banks' submissions that differed from the final ISDAfix Rate on each day. I then calculate the averages across days in each year.

<sup>/2</sup> Results for 2014 only include the period August 1, 2014 through December 31, 2014. In the period January 2014 – July 2014, ICAP was removed from the ISDAfix rate-setting process, and ICE did not take over the ISDAfix rate-setting process until August 2014. Thomson Reuters was in charge of the ISDAfix rate-setting process in this period, and I understand that banks' ISDAfix submission data for that period are not available.

ii. *Defendants' unanimous submissions cannot be explained by market factors*

28. I next examine whether the observed lack of variation in banks' ISDAfix submissions can be explained either by a lack of variation in market rates or by a lack of variation in final ISDAfix rates or ICAP Reference Rates.

29. *Variation in market rates.* One way to examine if Defendant Banks' unanimous submissions are consistent with competitive market behavior is to compare variations in Defendant Banks' ISDAfix submissions with variations in market rates around 11 am. As above, I measure variations in market rates using the measure of dispersion.<sup>23</sup> I follow the process used by ICAP and Defendant Banks' by first discarding the highest and lowest submissions.<sup>24</sup> Figure 17 presents the quarterly average measure of dispersion of Defendant Banks' ISDAfix submissions for the 5-year tenor. As shown in Figure 17, the measure of dispersion of ISDAfix submissions increased substantially from late 2012 to 2013.<sup>25</sup>

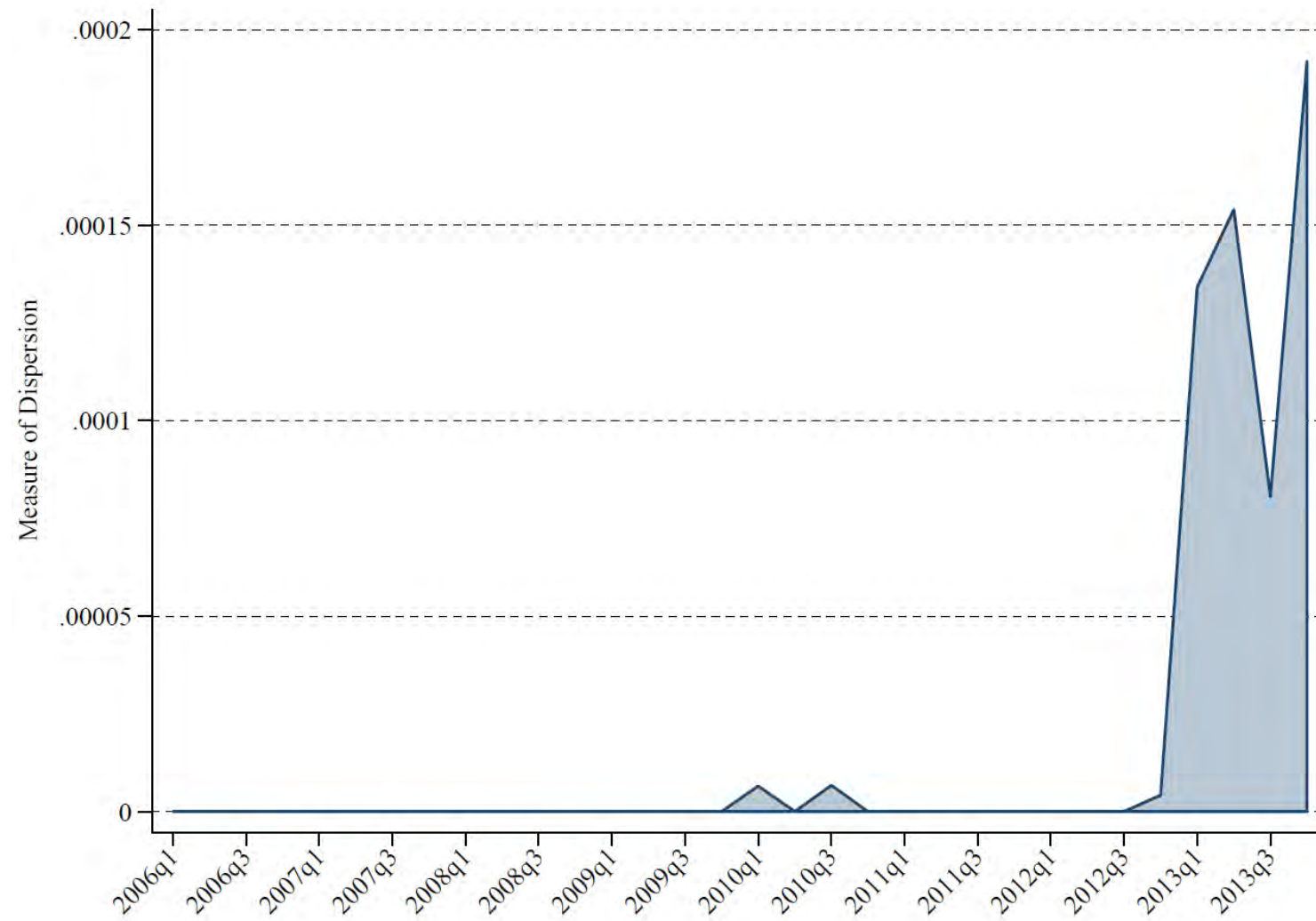
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<sup>23</sup> See footnote 19. In calculating the measure of dispersion of submissions, I drop days with apparent data errors: if on a given day, the maximum submission is more than two basis points larger than the median submission, or if the minimum submission is more than two basis points smaller than the median submission.

<sup>24</sup> Specifically, before October 27, 2008, ISDA and ICAP's rule was to exclude the top and bottom four submissions. On October 27, 2008, the rule was changed to exclude the top and bottom two submissions. See ICM-001521066-67, at 66.

<sup>25</sup> I observe the same pattern in other tenors. See Figures A37-A48 in Appendix III.

FIGURE 17  
MEASURE OF DISPERSION FOR DEFENDANT BANKS' ISDAFIX SUBMISSIONS  
5-YEAR TENOR



Source: ICAP production data.

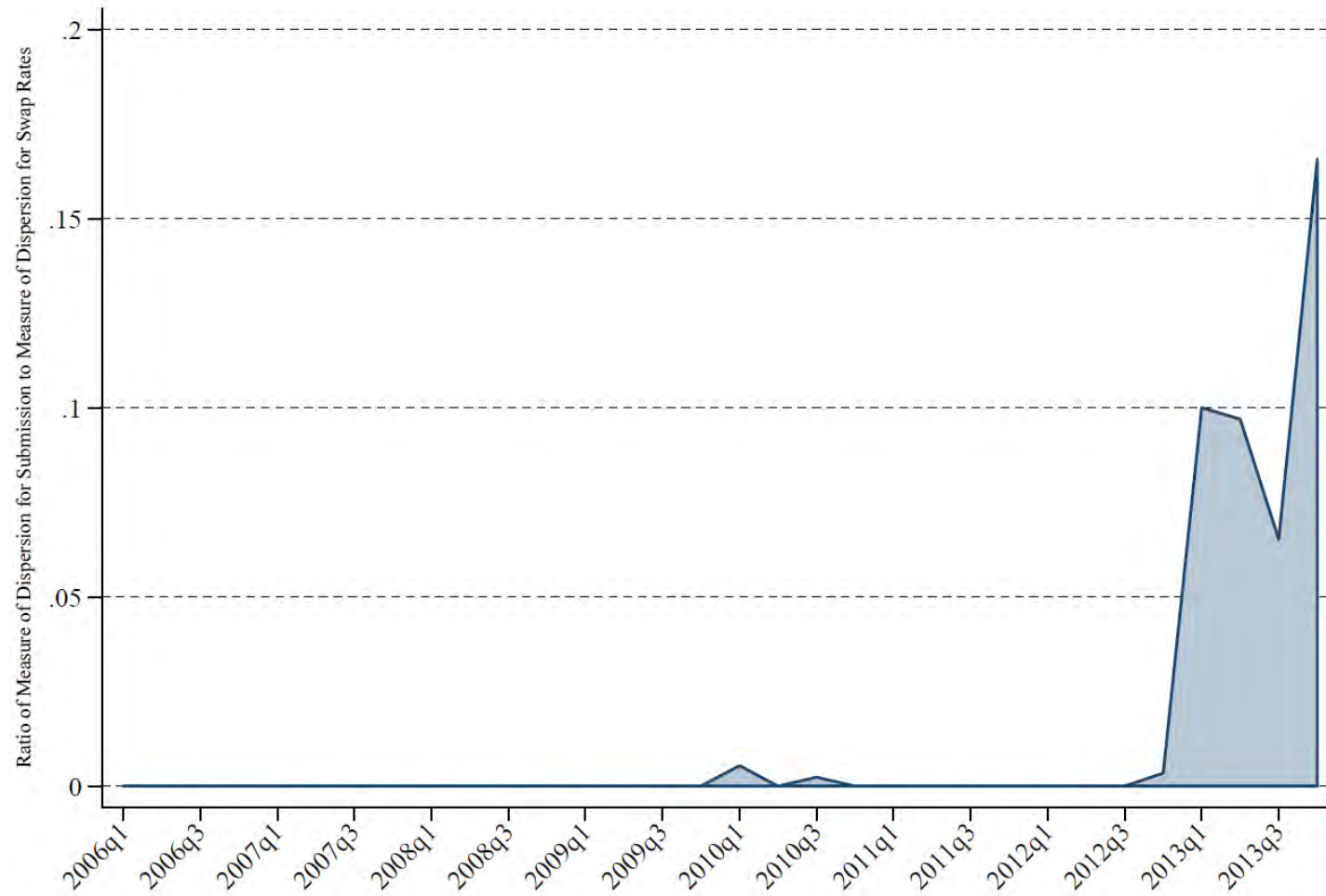
30. One possible explanation for the increase in the measure of dispersion of Defendant Banks' ISDAfix submissions is that market volatility as indicated by the measure of dispersion of market rates around 11 am increased. In order to test this explanation, I calculate the ratio of (1) the measure of dispersion of Defendant Banks' ISDAfix submissions to (2) the measure of dispersion of market rates on Screen 19901 between 11:00:00 am and 11:14:59 am. The resulting statistic effectively holds constant market volatility as measured by variations in market rates around 11 am. As shown in Figure 18, the quarterly average of this ratio also increased substantially from late 2012 to 2013.<sup>26</sup>

31. Thus, Defendant Banks' unanimous submissions in 2006 through late 2012, as well as the sharp contrast in variations of ISDAfix submissions in 2006 through late 2012 compared to late 2012 and 2013, cannot be explained by changes in variations in market rates around 11 am.

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<sup>26</sup> I observe the same pattern in other tenors. See Figures A49-A59 in Appendix III. As robustness check, rather than using the measure of dispersion of market rates on Screen 19901 between 11:00:00 am and 11:14:59 am, I use the measure of dispersion of market rates on Screen 19901 between 10:45:00 am and 10:59:59 am (see Figures A60-A71 in Appendix III) as well as between 10:50:00 am and 11:09:59 am (see Figures A72-A83 in Appendix III).

FIGURE 18  
 RATIO OF MEASURE OF DISPERSION FOR ISDAFIX SUBMISSIONS TO  
 MEASURE OF DISPERSION FOR MARKET RATES BETWEEN 11:00:00 AM AND 11:14:59 AM  
 5-YEAR TENOR



Source: ICAP production data.

32. *Variation in final ISDAfix rates or ICAP Reference Rates.* An alternative way to examine if Defendant Banks' unanimous submissions are consistent with competitive market behavior is to compare variations in Defendant Banks' ISDAfix submissions with variations in the final ISDAfix rate or the ICAP Reference Rate. I again measure variations using the measure of dispersion. To control for variations in ISDAfix submissions driven by variations in the ISDAfix rate, I calculate the ratio of (1) the measure of dispersion of Defendant Banks' ISDAfix submissions to (2) the measure of dispersion of final ISDAfix rates.<sup>27</sup> The resulting statistic effectively holds constant variations in final ISDAfix rates. As shown in Figure 19, the quarterly average of this ratio also increased substantially from late 2012 to 2013.<sup>28</sup>

33. Similarly, to control for variations in ISDAfix submissions driven by variations in the ICAP Reference Rate, I calculate the ratio of (1) the measure of dispersion of Defendant Banks' ISDAfix submissions to (2) the measure of dispersion of ICAP Reference Rates.<sup>29</sup> The resulting statistic effectively holds constant variations in ICAP Reference Rates. As shown in Figure 20, the quarterly average of this ratio also increased substantially from late 2012 to 2013.<sup>30</sup>

34. Thus, Defendant Banks' unanimous submissions in 2006 through late 2012, as well as the sharp contrast of variations in ISDAfix submissions in the years 2006 through late 2012 compared to late 2012 and 2013, cannot be explained by changes in variations in the final ISDAfix rate or the ICAP Reference Rate.

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<sup>27</sup> Since there is only one observation of the final ISDAfix rate for a given tenor on a given day, I use a rolling five-day window when calculating the measure of dispersion of final ISDAfix rates.

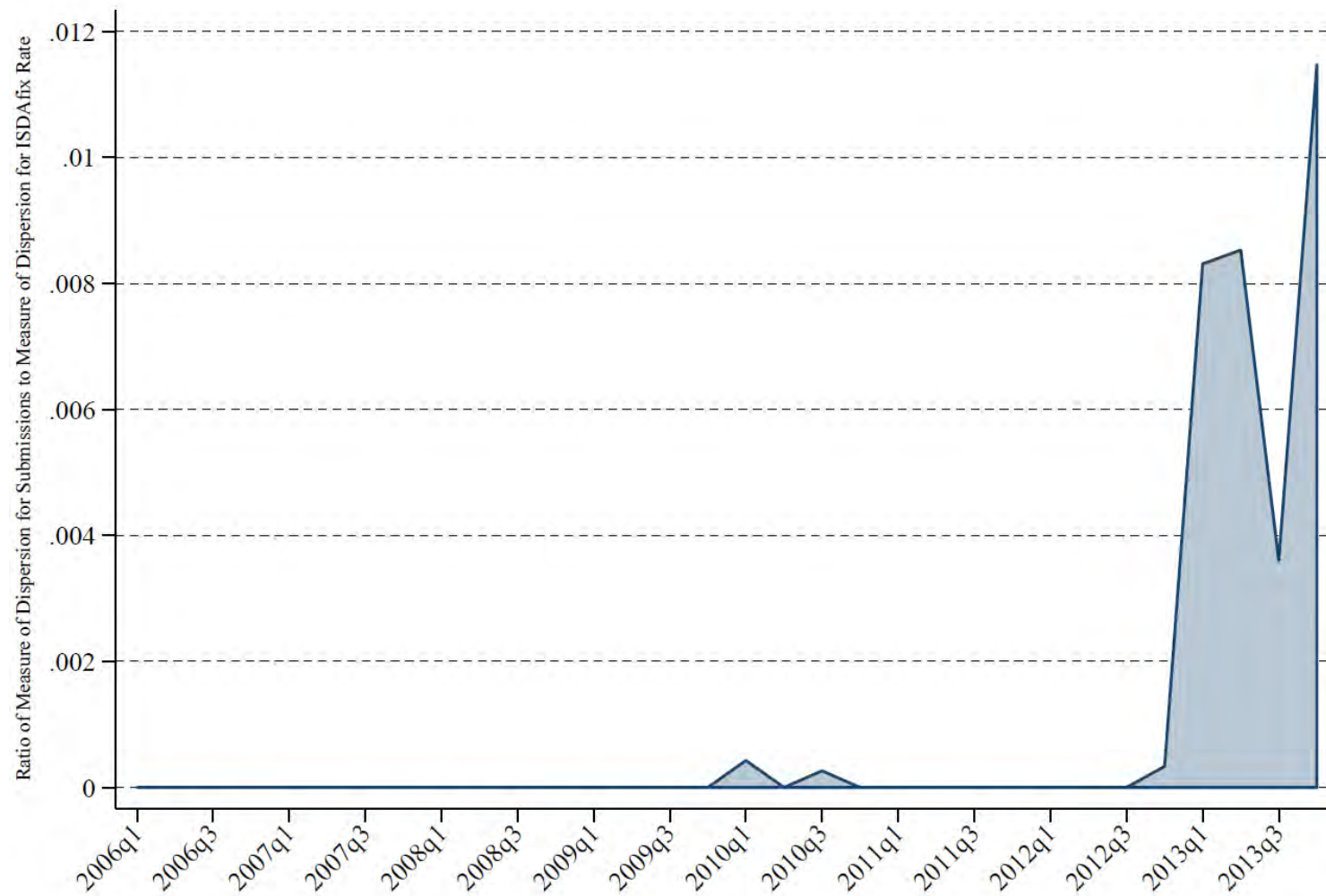
<sup>28</sup> I observe the same pattern in other tenors. See Figures A84-A95 in Appendix III.

<sup>29</sup> Since there is only one observation of the ICAP Reference Rate for a given tenor on a given day, I use a rolling five-day window when calculating the measure of dispersion of ICAP Reference Rates.

<sup>30</sup> I observe the same pattern in other tenors. See Figures A96-A106 in Appendix III.

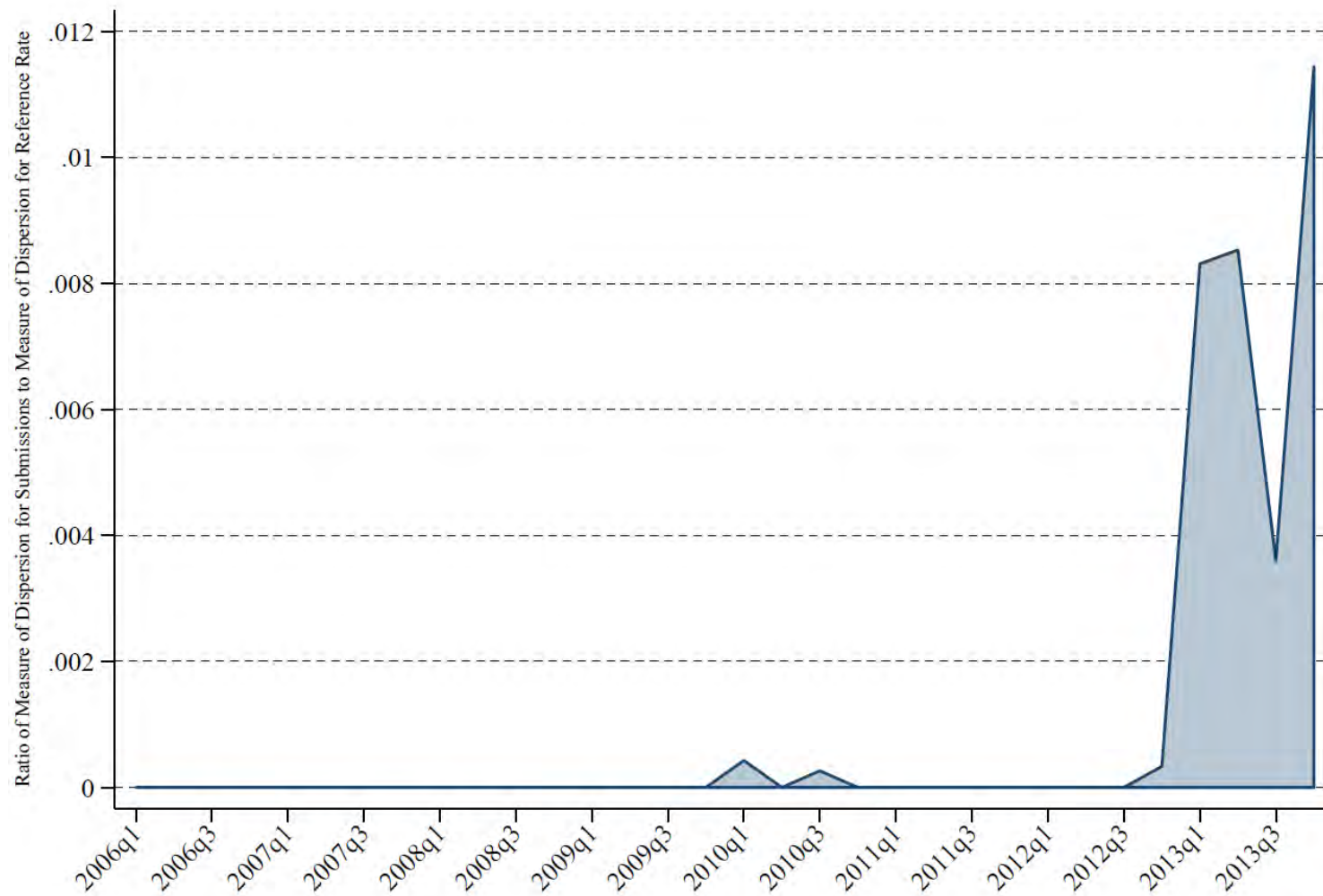


FIGURE 19  
RATIO OF MEASURE OF DISPERSION FOR ISDAFIX SUBMISSIONS TO MEASURE OF DISPERSION FOR FINAL ISDAFIX RATES  
5-YEAR TENOR



Source: ICAP production data.

FIGURE 20  
RATIO OF MEASURE OF DISPERSION FOR ISDAFIX SUBMISSIONS TO MEASURE OF DISPERSION FOR ICAP REFERENCE RATES  
5-YEAR TENOR



Source: ICAP production data.

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iii. *Rubber stamping the ICAP Reference Rate is against a Defendant Bank's unilateral interests in the absence of an agreement*

35. When a Defendant Bank [REDACTED]

[REDACTED]<sup>31</sup> the bank [REDACTED]

[REDACTED]<sup>32</sup> When a bank violated ISDA's requirement, the bank was acting against its own self-interest in the absence of an agreement. Such a bank ran the risk that ISDA would learn of the violation and take appropriate action such as removing the bank, notifying investors, or bringing the matter to the relevant regulatory authorities.<sup>33</sup>

36. The record provides substantial evidence (all of which is common to the class) that Defendants were aware of the potential costs of rubber stamping. For example, on November 5, 2007, one ICAP broker mentioned to another that the USD ISDAfix process [REDACTED] and presents [REDACTED]<sup>34</sup> Documents also show that ICAP understood what revelations regarding LIBOR manipulation meant for the future of USD ISDAfix, commenting internally that [REDACTED]<sup>35</sup> Defendant

<sup>31</sup> See, e.g., Deposition of Andre Leger (June 5, 2017), 36:5-8, 40:9-18, 47:1-5; BNPP\_AK\_00038833-36, at 33.

<sup>32</sup> BNPP\_AK\_00000885-88, at 88.

<sup>33</sup> ISDAFIX-0030174-78, at 75 (banks that [REDACTED]); Farrer Deposition, 163:10-16 (ICAP and Reuters had [REDACTED]).

<sup>34</sup> ICM-000195166-67, at 67.

<sup>35</sup> ICM-000006776-77, at 76.

Banks were also well aware of the risks associated with their corrupt rubber-stamping practice. When news broke in the media that questions were being raised about manipulation of the 11 am USD ISDAfix process, traders responded [REDACTED]

[REDACTED]<sup>36</sup>

37. Submitting banks were aware when they made rubber-stamped submissions that the reference rate was rigged and thus did not reflect the competitive rate or their own economic view of swap rates.<sup>37</sup> Although a one-shot manipulation of the reference rate to drive it off the competitive rate might be undetected by submitting banks and regarded as private information (thus causing a permanent price effect), such manipulated ICAP Reference Rates would not go undetected day-after-day for years. The repeated nature of the ISDAfix rate-setting procedure makes such surprises unlikely to persist but for the existence of a conspiracy. Thus, by rubber stamping, a Defendant Bank understood that it had not submitted a rate that was [REDACTED]

[REDACTED]<sup>38</sup> As discussed above, this is against the bank's unilateral self-interest in the absence of an agreement since the bank ran the risk that ISDA would learn of the violation and take appropriate action such as removing the bank, notifying investors, or bringing the matter to the relevant regulatory authorities.

38. Changes in Defendants' submission behavior also suggest that rubber stamping was against Defendant Banks' independent self-interest. As shown in Figures 17-20, variations in Defendant Banks' submissions increased substantially starting in late 2012, and the variations in Defendant Banks' submissions cannot be explained by changes in market rate variations. This

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<sup>36</sup> Citi-ISDAFIX-Civil-00071232-36, at 32; see also High Exhibit 3B (Barc-IFX\_00007206) ([REDACTED]).

<sup>37</sup> I provide several examples regarding this point in Section III.A.iv and footnote 69.

<sup>38</sup> BNPP\_AK\_00000885-88, at 88.

pattern change shows that unanimous, rubber-stamping submissions are not optimal when Defendant Banks act according to their independent self-interests. Otherwise, their submissions would show levels of variation comparable to those in late 2012 and 2013.

39. A Defendant Bank without exposure on a given day has no economic incentive, in the absence of an agreement, to make a submission that does not “reflect the midpoint of where that dealer would itself offer and bid a swap to a dealer of good credit as of 11:00 a.m. Eastern Time.”<sup>39</sup> But, as demonstrated in this section, Defendant Banks rubber stamped their submissions almost every day. As discussed above, such rubber-stamped submissions were against the independent self-interests of a Defendant Bank in the absence of an agreement.

40. Indeed, if no bank were to rubber stamp a manipulated ICAP Reference Rate, then the manipulation would have no effect on the final ISDAfix rate. Since a manipulated ICAP Reference Rate deviates from the competitive level, the fewer the number of banks rubber stamping that ICAP Reference Rate, the more likely it is that any rubber-stamped submissions would be excluded in the topping and tailing process. Thus, by rubber stamping a manipulated ICAP Reference Rate, a bank would undermine the competitiveness of the ISDAfix rate-setting process and increase the likelihood that a manipulated ICAP Reference Rate would become the final ISDAfix rate. However, Defendant Banks had an economic incentive in the absence of an agreement to ensure that the final ISDAfix rate on which their clients relied in making financial investment decisions reflected the competitive rate. This is also illustrated by the fact that Defendant Banks hid the information from their clients and the public that they collectively rubber

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<sup>39</sup> CFTC, *In the Matter of Barclays PLC, Barclays Bank PLC, and Barclays Capital Inc., Order Instituting Proceedings Pursuant to Sections 6(c) and 6(d) of the Commodity Exchange Act, Making Findings, and Imposing Remedial Sanctions* (May 20, 2015) (hereinafter “CFTC, In the Matter of Barclays”), p. 2; see also ICM-001514494 [REDACTED].

stamped a manipulated ICAP Reference Rate.<sup>40</sup> Had Defendant Banks been unconcerned that this was anti-competitive, then they would not have attempted to hide it, which the record indicates they did. Thus, it is against a Defendant Bank's unilateral self-interest in the absence of an agreement to rubber stamp a manipulated ICAP Reference Rate and undermine the competitiveness of the ISDAfix rate-setting process.

41. However, such rubber-stamped submissions were consistent with the existence of an agreement to rig ISDAfix rates. A specific Defendant Bank without exposure on a given day would have an economic incentive to rubber stamp the ICAP Reference Rate in the presence of an agreement. This follows because the specific Defendant Bank would expect the same cooperative response on a given trading day in the future from other Defendant Banks (including those without exposure on that day) when the Defendant Bank in question had exposure.

*iv. Common evidence shows that the ICAP Reference Rate served as a focal point for coordination among Defendant Banks with respect to their USD ISDAfix submissions*

42. As discussed above, Defendant Banks rubber stamped the ICAP Reference Rate on almost every day until late 2012. Such unanimous submissions, as well as their dissipation after late 2012, cannot be explained by market factors. Defendant Banks' rubber-stamped submissions were against their unilateral interests in the absence of an agreement. This leads to the question whether the existence of ICAP Reference Rate itself and the fact that ICAP pre-populated each

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<sup>40</sup> See, for example, RBS-Alaska-ISDA-001110364-68, at 67

001516979

; ICM-

BARC-IFX 00011635-36, at 35

bank's submission page with the ICAP Reference Rate would facilitate Defendant Banks' ability to manipulate ISDAfix by banging the close without extensive direct communications.

43. USD ISDAfix was set by ICAP according to a methodology different from both ISDA's official published methodology and from how ISDAfix was set for every other currency.<sup>41</sup> Most notably, the ISDAfix rate-setting process for all other currencies does not involve a reference rate. There is, thus, no apparent reason why a reference rate was required for the USD ISDAfix rate-setting process. Neither ISDA, nor ICAP, nor Defendant Banks have provided any economically sound explanation for why the USD ISDAfix rate-setting process was set up differently than other currencies.<sup>42</sup> The inference is compelling that the banks and ICAP modified and organized the USD ISDAfix rate-setting process to make it uniquely susceptible to manipulation.<sup>43</sup> These actions constitute a plus factor, i.e., Defendants acted against their independent self-interests but for the existence of an agreement.

44. As an economic matter, the process used for USD ISDAfix was especially well suited to facilitate the USD panel banks' manipulation of the fixing outcome. Substantial evidence indicates that the various USD panel banks recognized this and exploited the process.<sup>44</sup> Notably, while government regulators in the United States have imposed significant fines for manipulating

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<sup>41</sup> See Farrell Expert Report, ¶¶ 53-57. During the proposed Class Period, ICAP was responsible for polling the panel banks involved in the ISDAfix rate-setting process for one currency: USD ISDAfix. For all of the other ISDAfix currencies (including EUR, HKD, JPY, GBP, and CHF), Thomson Reuters served in that role.

<sup>42</sup> See, e.g., Deposition of [REDACTED] (January 27, 2017) (hereinafter "[REDACTED] Deposition"), 160:15-163:10; Deposition of [REDACTED] (March 27, 2017), 62:24-66:15; [REDACTED] Deposition, 88:16-89:15, 193:3-9; [REDACTED] Deposition, 114:18-115:4, 243:23-244:11, 297:8 -299:17; Deposition of [REDACTED] (June 27, 2017), 107:14-107:25.

<sup>43</sup> See [REDACTED] Deposition, 77:21-83:11, 153:7-18, 193:3-9, 351:10-353:14; [REDACTED] Deposition, 198:19-25; 206:3-207:5; Deposition of [REDACTED] (June 8, 2017) (hereinafter "[REDACTED] Deposition"), 29:21-30:4, 30:18-31:10, 35:14-19; Deposition of [REDACTED] (April 4, 2017) (hereinafter "[REDACTED] Deposition"), 79:2-80:24.

<sup>44</sup> As a Barclays trader stated: [REDACTED] (BARC-IFX\_00006704.) Additional evidence showing that Defendant Banks were aware of each other's banging the close activities is provided below in this section.



USD ISDAfix in connection with their ongoing USD ISDAfix investigation, regulators have not charged that similar manipulation occurred for any of the other currencies. This highlights that in the setting process for USD ISDAfix the participants knowingly adopted and followed a corrupted process.

45. ICAP pre-populated each bank's submission page with the ICAP Reference Rate, a process that was not disclosed publicly.<sup>45</sup> In 2010, ISDA recommended that the USD methodology be aligned with that of the other currencies.<sup>46</sup> Several of the banks and ICAP opposed this recommendation,<sup>47</sup> and it was dropped without further consideration in early 2011.

46. Circulation of the ICAP Reference Rate in conjunction with the Defendant Banks' uniform rubber stamping made USD ISDAfix uniquely susceptible to manipulation.<sup>48</sup> As a result, USD ISDAfix did not represent an average derived from competitors' independent views of the market for interest rate swaps. USD ISDAfix was, instead, little more than a snapshot of ICAP's own rates for USD interest rate swaps and Treasuries at 11:00 am.

47. Accordingly, for the Defendant Banks, any manipulation of rates on ICAP's platforms would be reflected in the final, published USD ISDAfix rates. Each party to the secret agreement thus knew that it could manipulate ISDAfix by affecting the rates on the 19901 screen at 11:00 am.

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<sup>45</sup> See [REDACTED] Deposition, 81:16-83:11; [REDACTED] Deposition, 112:25-115:4.

<sup>46</sup> ISDAFIX-0018677-78, at 77. [REDACTED]

<sup>47</sup> Specifically, [REDACTED]. ISDAFIX-0017760-61, at 61.

<sup>48</sup> [REDACTED] Deposition, 206:25-207:5.

48. Ample evidence, all common to class members, indicates that the Defendants recognized and exploited the vulnerability in the USD ISDAfix process that they themselves created.<sup>49</sup> In an explicit acknowledgement, for example, a Barclays trader wrote in 2008, after years of manipulation, [REDACTED]

[REDACTED]<sup>50</sup> But the USD panel banks did not change their behavior at that time—in fact, the economic evidence shows that they did not change their behavior in a meaningful way until government regulators begin to investigate their conduct in late 2012 (see Section III.B).

49. The structure of the USD ISDAfix setting process meant that each panel bank knew it could manipulate the USD ISDAfix process relatively easily. All a panel bank had to do was enter into transactions with ICAP at 11 am in ways intended to move prices displayed on the 19901 Screen and ICAP’s BrokerTec platform. As discussed in Section II, these manipulated rates nearly always became the final ISDAfix rates.<sup>51</sup>

50. Indeed, appraised of the evidence of collusion among Defendant Banks to rig ISDAfix rates, ISDA removed ICAP from its role in the ISDAfix rate-setting process: “Icap Plc is losing its role setting the benchmark for interest-rate swaps as regulators look into whether banks manipulated the measure. Bloomberg News reported last year that U.S. regulators have found

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<sup>49</sup> See, for example, BARC-IFX\_00007401-402, at 401 (Barclays, August 17, 2006: [REDACTED]; BARC-IFX\_00007185 (Barclays, April 5, 2007: [REDACTED]). See further examples in Section III.A.iv and footnote 69.

<sup>50</sup> See BARC-IFX-C\_00001230.

<sup>51</sup> The “topping and tailing” process eliminates a given number of the highest and lowest rates submitted. See ICM-001521066-67, at 66. Thus, not all banks need to rubber stamp the reference rate in order to manipulate the final ISDAfix rate.

evidence that the rate, which is set daily based on data reported by banks, was manipulated at the expense of institutional investors. ISDA, a trade group for the derivatives industry, said in September it planned to set all of the rates based on actual trades, instead of trusting the information banks submitted.”<sup>52</sup> In August 2014, ISDA appointed ICE Benchmark Administration (“IBA”), a subsidiary of Intercontinental Exchange, Inc. (“ICE”), as administrator of ISDAfix.<sup>53</sup>

51. ICE fundamentally changed the ISDAfix rate-setting process by removing the reference rate and eliminating Defendant Banks’ submissions:

Intercontinental Exchange will next month switch the way it calculates Isdafx in a bid to bolster market confidence in one of the key benchmarks for the interest rate swaps market. The US derivatives exchange said on Monday that it would change from mid-February to *publishing rates based on tradeable quotes rather than submissions by a panel of banks*. The move is a central part of ICE’s efforts to bolster the integrity of the rates, which serve as key benchmarks and underpin thousands of contracts in the \$400tn over-the-counter swaps market. Global regulators have sought to remove conflicts of interest and improve the governance and accuracy of a host of benchmarks that provide critical yardsticks for opaque and thinly-traded markets.<sup>54</sup>

52. The fact that ICE’s rate-setting process removed the reference rate and eliminated Defendant Banks’ submissions indicates that there was no need for ICAP to use a reference rate in the rate-setting process.

53. ISDAfix benchmarks used for other currencies, e.g., the Euro and the British Pound Sterling, also do not use a reference rate.<sup>55</sup> A report prepared by the consulting firm Oliver Wyman

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<sup>52</sup> Finch, G. (2014), “ISDA Puts Out to Tender Role of ISDAFIX Benchmark Administrator,” *Bloomberg*, available at [www.bloomberg.com/news/2014-02-24/isda-puts-out-to-tenderrole-of-ISDAFIX-benchmark-administrator.html](http://www.bloomberg.com/news/2014-02-24/isda-puts-out-to-tenderrole-of-ISDAFIX-benchmark-administrator.html) (accessed on July 27, 2017).

<sup>53</sup> “ICE Benchmark Administration Completes ISDAfix Transition,” *Intercontinental Exchange* (2014), available at <http://ir.theice.com/press/press-releases/all-categories/2014/08-04-2014> (accessed on July 27, 2017).

<sup>54</sup> Stafford, P. (2015), “ICE to Change Isdafx Calculation,” *Financial Times*, available at [www.ft.com/intl/cms/s/0/e778d3d6-a56e-11e4-ad35-00144feab7de.html#axzz3QGnQh9M8](http://www.ft.com/intl/cms/s/0/e778d3d6-a56e-11e4-ad35-00144feab7de.html#axzz3QGnQh9M8) (accessed on July 27, 2017) (emphasis added).

<sup>55</sup> ICM-000108523, Oliver Wyman (August 27, 2013), “Strengthening ISDAfix: Way Forward for US Dollar Fixing,” pp. 1-13. See also ISDAFIX-0028820-24.

concluded that: “[REDACTED]” was preferred to the unique USD ISDAfix rate-setting process.<sup>56</sup>

54. From an economic perspective, ICAP’s circulation of a pre-populated reference rate served as a focal point for coordination among Defendant Banks with respect to their USD ISDAfix submissions, facilitating their ability to manipulate ISDAfix without extensive communications with each other. A focal point is an economic concept arising from game-theory that was introduced by Nobel-prize winning economist Thomas Schelling.<sup>57</sup> As summarized by fellow Nobel-prizing winning economist Roger Myerson: [A] focal point is “anything in a game’s environment or history that focuses the players’ attention on one equilibrium [and] may lead them to expect it, and so rationally to play it. This *focal-point effect* opens the door for cultural and environmental factors to influence rational behavior. . . . Schelling’s focal-point effect should be counted as one of the most important ideas in social theory.”<sup>58</sup>

55. As noted by Professor Myerson, a focal point can focus “players’ attention on one equilibrium.”<sup>59</sup> This is economically important because strategic interactions between firms often lead to a number of possible outcomes, each of which may be an equilibrium. In order to achieve the most mutually beneficial outcome, especially with little or no communication, firms need to effectively coordinate their actions. A focal point can serve to do that by effectively eliminating some or all equilibrium outcomes other than one. As summarized in a well-known textbook:

Thomas Schelling (1960) suggested that in the case of multiple equilibria, expectations may be coordinated by focal points. Focal points are attributes of the

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<sup>56</sup> ICM-000108523, Oliver Wyman (August 27, 2013), “Strengthening ISDAfix: Way Forward for US Dollar Fixing,” p. 7.

<sup>57</sup> Schelling, T. (1980), *The Strategy of Conflict*, Cambridge, MA: Harvard University Press.

<sup>58</sup> Myerson, R. (2009), “Learning from Schelling’s Strategy of Conflict,” *Journal of Economic Literature*, vol. 47, no. 4, pp. 1109-1125, at 1111 and 1112 (emphasis in original).

<sup>59</sup> Myerson, R. (2009), “Learning from Schelling’s Strategy of Conflict,” *Journal of Economic Literature*, vol. 47, no. 4, pp. 1109-1125, at 1111.

strategies or payoffs that are conspicuous or prominent and therefore coordinate expectations and choices of players when there are multiple Nash equilibria. Schelling argued that cultural and historical norms determine what is focal. One of his examples was “Meeting in New York,” a game in which two friends agree to meet on a certain day, but forget to arrange a location or a time. Schelling suggested that they would still find each other—at the information booth at Grand Central Station at noon!<sup>60</sup>

56. In the present case, Defendant Banks used the ICAP Reference Rate as a focal point to facilitate their conspiracy, obviating the need for direct communications. Indeed, it would have been against the unilateral interests of any given bank in the absence of an agreement for a reference rate to be used in the ISDAfix rate-setting process. If only one or two banks were to [REDACTED]<sup>61</sup> to rig the ISDAfix rate, the “topping and tailing” process likely would have eliminated those submissions and their impact on the ISDAfix rate would be minimum. As ISDA claimed, [REDACTED]

[REDACTED]<sup>62</sup> However, with the ICAP Reference Rate serving as a focal point, “the most widely-concerted manipulation” became the reality where all or almost all submitting banks simply rubber stamped the ICAP Reference Rate across all tenors on more than 90 percent of the days in the nearly seven years from 2006 through late 2012. Thus, the topping and tailing process was converted from a safeguard against manipulation to a mechanism facilitating Defendants’ manipulation. If a competitive bank acting unilaterally made submissions consistent with ISDA’s requirement (i.e., its submissions reflected the midpoint of where that bank would itself offer and bid a swap to a dealer of good credit as of 11:00 am Eastern Time), but other banks colluded by rubber stamping their submissions, then the competitive bank’s submissions

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<sup>60</sup> Church, J. and Ware, R. (2000), *Industrial Organization: A Strategic Approach*, Boston, MA: Irwin McGraw-Hill, p. 222.

<sup>61</sup> ISDAFIX-0013798-99, at 98.

<sup>62</sup> ISDAFIX-0013798-99, at 98.

would be discarded by the topping and tailing process. Thus, the final ISDAfix rate would not reflect the rate at which a competitive bank would offer and bid swaps.

57. A given bank would not want the ISDAfix rate-setting process to use a reference rate unless that bank sought to facilitate the communication of pricing information across horizontal competitors. Moreover, if a bank were acting in its independent interest and learned this practice was being used, it would be motivated from an economic perspective to report the use of the reference rate to ISDA or government authorities in an effort to have the practice stopped. The fact that this did not happen is itself further economic evidence of Defendants' coordination.

58. Defendant Banks' awareness that their collective interests were served by the use of the ICAP Reference Rate in the ISDAfix rate-setting process is illustrated by their resistance to a change proposed in 2010 regarding that process. In June 2010, an article published in the *Financial Times* noted that ISDAfix rates were set in "an opaque process dominated by barely a handful of banks."<sup>63</sup> The article caused substantial consternation among traders at Defendant Banks, with several traders stating: "[REDACTED]"

[REDACTED]<sup>64</sup>

59. In response to the *Financial Times* article, ISDA in December 2010 recommended changing the rate-setting process: "[REDACTED]"

[REDACTED]

[REDACTED]<sup>65</sup> As discussed above, ISDAfix benchmarks established for other currencies do not use a reference rate in the ISDAfix rate-setting process. Thus, ISDA's

<sup>63</sup> Citi-ISDAFIX-Civil-00071232-36, at 32.

<sup>64</sup> Citi-ISDAFIX-Civil-00071232-36, at 32; see also [REDACTED] Exhibit 3B (Barc-IFX\_00007206) [REDACTED]

<sup>65</sup> JPMC-ISDA00064674-76, at 76.

December 2010 proposal would have eliminated the ICAP Reference Rate in the rate-setting process for the U.S. dollar ISDAfix rate. This would have eliminated a key mechanism that the banks used to share pricing information and fix prices.

60. ISDA also noted that ICAP [REDACTED]

[REDACTED]

[REDACTED]<sup>66</sup> [REDACTED]

[REDACTED]<sup>67</sup> After considering the Defendant Banks' opinions, ISDA dropped its proposed change to the ISDAfix rate-setting process.<sup>68</sup>

61. As discussed above, economic evidence, all of which is common to the class, strongly indicates that the Defendant Banks were well aware of the role of the reference rate mechanism in facilitating their ability to manipulate USD ISDAfix. There is also extensive documentary evidence showing that Defendant Banks knew panel banks regularly manipulated USD ISDAfix rates.<sup>69</sup> For example, in its Barclays' order, the CFTC states:

<sup>66</sup> JPMC-ISDA00064674-76, at 76.

<sup>67</sup> ISDAFIX-0012931-32, at 31 (March 4, 2011 email from [REDACTED] See also BNPP\_AK\_00287653-55, at 53.

<sup>68</sup> See [REDACTED] Deposition, 40:12-41:7.

<sup>69</sup> See, for example, ICM-000204575-88, at 78 (Lehman Brothers, May 9, 2007. [REDACTED] Citi-ISDAFIX-Civil-00065836 (Citigroup, June 18, 2007: [REDACTED]; BARC-IFX\_00007138 (Barclays, July 3, 2007. JP Morgan: [REDACTED]; Citi-ISDAFIX-Civil-00025956-58, at 58 (Citigroup, October 3, 2007: [REDACTED] BNPP\_AK\_00085791-94, at 92 (BNPP, December 10, 2007: [REDACTED]

[REDACTED] DB-SDNY-ISDAFIX\_00248685 (Deutsche Bank, December 21, 2007, [REDACTED]

[REDACTED] BNPP\_AK\_00085557 (BNPP, May 19, 2008. [REDACTED] DB-



First, Barclays traders bid, offered, and/or executed swap spread trades at and around Swaps Broker's 11:00 a.m. print to affect prices on the 19901 screen and thereby increase or decrease Swaps Broker's reference rates and spreads and influence the final published USD ISDAFIX. As one Barclays swaps trader ("Swaps Trader 1") remarked on March 7, 2007, USD ISDAFIX was "fucking random" and "what happens at eleven is the bloody thing moves like half a basis point up and down **because everybody's trying to bang the screen.**"<sup>70</sup>

62. Despite this knowledge, ICAP continued to circulate its reference rate, and every Defendant Bank continued to rubber stamp that rate. Knowledge of the manipulation was so pervasive by 2007 that one BNPP employee added as an internal meeting agenda item [REDACTED]

[REDACTED]

[REDACTED]<sup>71</sup>

63. In some instances when Defendant Banks were unsuccessful in rigging the ISDAfix rate, the market structure allowed ICAP to coordinate among Defendant Banks to alter their submissions retroactively, thus changing the final ISDAfix rate. For example, on April 17, 2007, an ICAP broker told a JPM trader: [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]<sup>72</sup>

64. On December 17, 2007, ICAP suggested to a Defendant Bank that it will work to have ISDAfix submitters change their polling submissions. [REDACTED] of Goldman wrote to ICAP broker [REDACTED]

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SDNY-ISDAFIX\_00142608-612, at 11 (Deutsche Bank, August 20, 2009. [REDACTED]

[REDACTED]; Citi-ISDAFIX-Civil-00101692 (Citigroup, October 14, 2010: [REDACTED]

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<sup>70</sup> CFTC, In the Matter of Barclays, p. 7 (emphasis added).

<sup>71</sup> BNPP\_AK\_00058133-35, at 34.

<sup>72</sup> JPMC-ISDA00054218.

[REDACTED] 73

Following this e-mail exchange, [REDACTED] (ICAP) wrote to [REDACTED] of Goldman on December 19, 2007 regarding this issue: [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] 74

65. In another such instance of retroactively altering Defendant Banks' submissions, on February 6, 2008, ICAP failed Goldman Sachs' attempt to bang the close:

[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]

66. Later on the same day, [REDACTED] of ICAP wrote to [REDACTED]: [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] 76

67. As another example, on July 17, 2008, ICAP asked all submitting banks to change their submissions following a request from Goldman Sachs. A majority of submitting banks made

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<sup>73</sup> ICM-000021637.

<sup>74</sup> GS-ISDAFIX-CIVIL-00001643.

<sup>75</sup> ICM-000021717.

<sup>76</sup> ICM-000021735.

the change, and Goldman Sachs got the print (the final ISDAfix rate) they requested. Shortly after 11:00 am, [REDACTED] of ICAP wrote to Goldman Sachs' [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]<sup>77</sup>

68. These retroactive changes in submissions cannot be justified on economic grounds as simply corrections of mistakes in the ICAP Reference Rate. As discussed in the following example, ICAP opined that Defendant Banks [REDACTED]

[REDACTED].

69. On August 15, 2008, [REDACTED] (ICAP) wrote to [REDACTED] (ISDA):

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]<sup>78</sup> [REDACTED] reported in an internal ICAP communication later that same day: [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]<sup>79</sup>

70. Accordingly, there is significant economic evidence (which would be common to the class) that the ICAP Reference Rate served as a focal point for price coordination among

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<sup>77</sup> GS-ISDAFIX-CIVIL-00003352.

<sup>78</sup> ICM-000000778-80, at 78.

<sup>79</sup> ICM-000000778-80, at 78.

Defendant Banks, facilitating their ability to manipulate final USD ISDAfix rates. Defendant Banks took advantage of the ISDAfix setting process, particularly the ICAP Reference Rate, by rubber stamping the ICAP Reference Rate on almost every day until late 2012. As discussed above, such unanimous submissions, as well as their dissipation after late 2012, cannot be explained by market factors. Defendant Banks' rubber-stamped submissions were against their unilateral interests in the absence of an agreement. The economic analyses of Defendant Banks' rubber stamping the ICAP Reference Rate and their economic incentives, as well as the common evidence on which that analysis is based, does not depend on an individualized inquiry regarding any specific class member. Rather, both the economic analysis and the evidence on which it is based are common to the class.

B. *Defendant Banks' banging the close activities provide common evidence of actions against their self-interests*

71. Plaintiffs allege that Defendant Banks, based on their understanding that the ICAP Reference Rate would be rubber stamped by submitting banks, banged the close to move the 19901 screen and the ICAP Reference Rate.<sup>80</sup> As explained by Mr. Farrell, there is substantial evidence that Defendants "banged the close" to manipulate the ICAP Reference Rate.<sup>81</sup>

72. Banging the close affects the final ISDAfix rate only if all but a few submitting banks rubber stamp the ICAP Reference Rate.<sup>82</sup> A simplified example shows why this is the case. Suppose *Bank A* successfully banged the close to manipulate the ICAP Reference Rate. But if the submitting banks, recognizing *Bank A*'s efforts to manipulate the ICAP Reference Rate, submit

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<sup>80</sup> See Farrell Expert Report, ¶¶ 240, for a discussion of banging the close.

<sup>81</sup> Farrell Expert Report, ¶¶ 20-21, 69-235.

<sup>82</sup> Recall that the "topping and tailing" process [REDACTED]. See ICM-001521066-67, at 66. Thus, not all banks need to rubber stamp the reference rate in order to manipulate the final ISDAfix rate.

bona fide rates based on where they would themselves offer and bid a swap (as required by ISDA), then the submissions and the final ISDAfix rate would not be affected by *Bank A*'s costly effort to bang the close because each submitting bank would have rejected the manipulated ICAP Reference Rate.

73. Thus, *Bank A* would have burned money to manipulate the ICAP Reference Rate, but would not have obtained any gains. Thus, it would not be profitable for a Defendant Bank to bang the close unless that bank understood that the other panel banks would collude to rubber stamp the reference rate. As discussed in Section III.A.i, Defendant Banks rubber stamped the ICAP Reference Rate on almost every day until late 2012, thus enabling their ability to rig the ISDAfix rate by banging the close and manipulating the ICAP Reference Rate.

74. Trades made to manipulate the ICAP Reference Rate are costly.<sup>83</sup> Such trades are against a firm's self-interest in the absence of an agreement to rubber stamp. As shown by Mr. Farrell, Defendant Banks sometimes spent what they called "ammo," but eventually failed in their efforts to rig ICAP Reference Rates.<sup>84</sup> The mere possibility that a "banging the close" strategy will fail makes it costly for a bank even to attempt to manipulate the ICAP Reference Rate. The record also provides substantial economic evidence showing that Defendants concluded that banging the close can be difficult and costly. Yet, Defendant Banks regularly employed bang-the-close strategies throughout the Class Period.<sup>85</sup>

75. Moreover, financial costs were not the only costs associated with banging the close. There were also potential legal costs. On July 19, 2012, a BNPP trader discussed the banging-the-close activities of another trader: [REDACTED]

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<sup>83</sup> Pirrong Expert Report, ¶¶ 61-63, 219.

<sup>84</sup> Farrell Expert Report, ¶¶ 204-205.

<sup>85</sup> Farrell Expert Report, ¶¶ 69-235.

[REDACTED]<sup>86</sup> As another example, a Barclays trader and a BNPP trader communicated directly with each other regarding potential legal costs of collusion:

76. Even though banging the close is against a firm's unilateral interests in the absence of an agreement, it can be profitable if an agreement exists. When (1) banks' banging the close efforts successfully manipulate the ICAP Reference Rate, and (2) the ICAP Reference Rate becomes the final ISDAfix rate through banks' coordinated efforts in rubber stamping the ICAP Reference Rate in their ISDAfix submissions, then Defendant banks can manipulate the final ISDAfix rate. Even a manipulation of 0.25 basis points can be worth [REDACTED]

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<sup>86</sup> ICM-000114944-49, at 47.

<sup>87</sup> BARC-IFX 00011635-36, at 35.

<sup>88</sup> MS-ALASKA00018093.

77. The fact that Defendants limited their ammo spent in banging the close indicates that their quotes and transactions were not intended for trading the interest rate derivatives, but simply for manipulating the ICAP Reference Rate. For example, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

89

C. *Actual benchmark interest rates differed from but-for benchmark interest rates*

78. Economic evidence showing that actual benchmark interest rates differ from but-for benchmark interest rates constitutes a plus factor. As Kovacic et al. discuss, such an analysis:

requires that a reliable predictive econometric model be estimated for a benchmark, usually a time period, where conduct is thought to be noncollusive. The predictive model would account for those demand and cost factors specific to the product market that are not potentially manipulable by a cartel (and only those factors), and it would similarly account for industry characteristics that are not potentially manipulable by a cartel. This model would be used to predict prices during a time period in which there was a suspicion of collusion. If actual prices fall outside the range of prices that would have prevailed under the noncollusive benchmark, with the range determined by a specified high confidence level, then this outcome would constitute a super plus factor.<sup>90</sup>

79. In the present matter, the damages model presented in Dr. Pirrong's expert report constitutes such a model.<sup>91</sup> Dr. Pirrong's damages model uses well-accepted economic methodologies and common evidence to determine that Defendants' conduct caused all or almost all proposed class members to incur injury-in-fact or antitrust impact. As Kovacic et al. state this

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<sup>89</sup> RBS-Alaska-ISDA-001110364-68, at 67.

<sup>90</sup> Kovacic, W., Marshall, R., Marx, L., and White, H. (2011), "Plus Factors and Agreement in Antitrust Law," *Michigan Law Review*, vol. 110, pp. 393-436, at 420 (footnote omitted).

<sup>91</sup> Pirrong Expert Report, Sections V-VIII.



finding constitutes “actions or conduct that could occur in the presence of a collusive agreement but that are highly unlikely to occur in its absence.”<sup>92</sup>

D. *Conclusion based on all plus factors*

80. I understand that “courts emphasize that these plus factors should not be viewed in a vacuum but rather should be considered in their entirety as the backdrop against which the alleged behavior takes place.”<sup>93</sup> As discussed by Kovacic et al., when multiple plus factors are present, the determination of whether there exist well-accepted economic methodologies and common evidence from which a fact-finder could determine the existence of an agreement can be made more precisely.<sup>94</sup>

81. After considering all the plus factors jointly, I conclude that common evidence exists that can be used to show that the particular structure of the USD ISDAfix rate-setting process allowed Defendants to rig ISDAfix rates. In particular, Defendant Banks rubber stamped the ICAP Reference Rate on almost every day until late 2012. Such unanimous submissions, as well as their dissipation after late 2012, cannot be explained by market factors. Defendant Banks’ rubber-stamped submissions were against their unilateral interests in the absence of an agreement. The ICAP Reference Rate served as a focal point for coordination among Defendant Banks with respect to their USD ISDAfix submissions, facilitating their ability to manipulate ISDAfix by banging the close without extensive direct communications on a daily basis.

82. In addition, USD ISDAfix was set by ICAP according to a methodology different from both ISDA’s official published methodology and from how ISDAfix was set for every other

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<sup>92</sup> Kovacic, W., Marshall, R., Marx, L., and White, H. (2011), “Plus Factors and Agreement in Antitrust Law,” *Michigan Law Review*, vol. 110, pp. 393-436, at 428.

<sup>93</sup> ABA Section of Antitrust Law (2012), *Antitrust Law Developments*, 7<sup>th</sup> ed., p. 11 (footnote omitted).

<sup>94</sup> See, e.g., Kovacic, W., Marshall, R., Marx, L., and White, H. (2011), “Plus Factors and Agreement in Antitrust Law,” *Michigan Law Review*, vol. 110, pp. 393-436, at 426-434.

currency.<sup>95</sup> The inference is compelling that the banks and ICAP modified and organized the USD process to make it uniquely susceptible to manipulation.<sup>96</sup> These actions constitute a plus factor, i.e., Defendants acted against their independent self-interests but for the existence of an agreement.

83. Moreover, when a Defendant Bank either “accepts” the ICAP Reference Rate or delegates to ICAP the authority to make its submission,<sup>97</sup> the bank violates ISDA’s requirement that the contributing bank should “provide a rate which is the mean of where that dealer would itself offer and bid a swap in the relevant maturity for a notional equivalent amount of US \$50 million or whatever amount is deemed market size in that currency for that tenor to an acknowledged dealer of good credit in the swap market. The rate should not be where the dealer sees mid-market away from itself, but should be a function of its own bid/offer spread.”<sup>98</sup> By breaching its contract with ISDA, the bank is acting against its own self-interest in the absence of an agreement.

84. In addition, Defendant Banks’ banging the close activities provide common evidence of actions against their self-interests but for the existence of an agreement. Dr. Pirrong’s expert report demonstrates that, as a result of Defendants’ conduct, actual interest rates differed from but-for benchmark interest rates in the proposed Class Period.

85. Finally, I conclude that there exist well-accepted economic methodologies and common evidence from which a fact-finder could determine the existence of an agreement to rig ISDAfix rates, i.e., that Defendants entered into a conspiracy to rig ISDAfix rates.

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<sup>95</sup> During the proposed Class Period, ICAP was responsible for polling the panel banks involved in the ISDAfix rate-setting process for one currency: USD ISDAfix. For all of the other ISDAfix currencies (including EUR, HKD, JPY, GBP, and CHF), Thomson Reuters served in that role.

<sup>96</sup> See ██████ Deposition, 77:21-83:11, 153:7-18, 193:3-9, 351:10-353:14; ██████ Deposition, 198:19-25; 206:3-207:5; ██████ Deposition, 29:21-30:4, 30:18-31:10, 35:14-19; ██████ Deposition, 79:2-80:24.

<sup>97</sup> See, e.g., ██████ Deposition, 81:13-82:14, 97:25-98:7.

<sup>98</sup> BNPP\_AK\_00000885-88, at 88 (emphasis in original).

#### IV. MARKET DEFINITION

86. Empirical evidence shows that there exists a relevant antitrust market for USD-denominated interest rate derivatives in a worldwide geographic market. Numerous public and confidential documents, as well as application of the U.S. Department of Justice (“DOJ”) and Federal Trade Commission (“FTC”) *Horizontal Merger Guidelines*, support this conclusion.

87. Antitrust market definition is a tool for identifying markets that must be examined in order to analyze structurally the ability of a firm or firms to exercise substantial market power or, equivalently, monopoly power.<sup>99</sup> The goal of market definition is to define a product and an associated geographic area in which a hypothetical monopolist or cartel would profitably exercise substantial market power. A firm with substantial market power is “one that is able to enhance its profits by raising prices substantially above marginal costs for a substantial volume of sales.”<sup>100</sup> Dr. Gregory Werden, Senior Economic Counsel, Antitrust Division, U.S. Department of Justice summarizes these market definition principles as follows:

Market delineation in antitrust is a means to an end rather than an end in itself. Markets are tools used to aid in the assessment of market power-related issues. The best tool for any task is one designed to perform it. A market delineated for one purpose may be not any more suitable for another than a dental drill is for coal mining or a mining drill for dentistry. Assuring that markets are suitable for the purposes to which they are put requires that a preliminary step be taken before market delineation. This step is the identification of who might exercise market power, against whom it might be exercised, and how it might be exercised.<sup>101</sup>

88. In the current context, Dr. Werden’s preliminary step is taken by asking “who might exercise market power”—Defendant Banks and ICAP that establish ISDAfix rates; “against whom

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<sup>99</sup> Schmalensee, R. (1987), “Standards for Dominant Firm Conduct: What Can Economics Contribute?” in *The Economics of Market Dominance* (D. Hay and J. Vickers, eds.), Oxford: Basil Blackwell, pp. 61-88, at 62.

<sup>100</sup> Schmalensee, R. (1987), “Standards for Dominant Firm Conduct: What Can Economics Contribute?” in *The Economics of Market Dominance* (D. Hay and J. Vickers, eds.), Oxford: Basil Blackwell, pp. 61-88, at 63.

<sup>101</sup> Werden, G. (1992), “Four Suggestions on Market Delineation,” *Antitrust Bulletin*, vol. 37, pp. 107-121 at 108.

it might be exercised”—proposed class members that entered into, received payments on, or terminated USD interest rate derivatives (including interest rate swaps and swaptions) with a Defendant during the proposed Class Period; and “how it might be exercised”—through an agreement to manipulate ISDAfix rates.

A. *Relevant product*

89. As emphasized in the *Horizontal Merger Guidelines*: “Market definition focuses solely on demand substitution factors, i.e., on customers’ ability and willingness to substitute away from one product to another in response to a price increase or a corresponding non-price change such as a reduction in product quality or service.”<sup>102</sup>

90. One test commonly used to assess relevant product market is the “hypothetical monopolist” test. The DOJ and FTC *Horizontal Merger Guidelines* describe the hypothetical monopolist framework or test as follows:

The Agencies employ the hypothetical monopolist test to evaluate whether groups of products in candidate markets are sufficiently broad to constitute relevant antitrust markets. The Agencies use the hypothetical monopolist test to identify a set of products that are reasonably interchangeable with a product sold by one of the merging firms.<sup>103</sup>

91. USD-denominated interest rate derivatives provide “unique trading opportunities,”<sup>104</sup> and there are no good substitutes for them. Participants have no other viable options to hedge risk or enter a new trade. Interest rate swaps and interest rate options were once

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<sup>102</sup> U.S. Department of Justice and the Federal Trade Commission, *Horizontal Merger Guidelines* (August 19, 2010) (hereinafter “*Horizontal Merger Guidelines*”), at § 4.

<sup>103</sup> *Horizontal Merger Guidelines*, at § 4.1.1. The discussion in the *Horizontal Merger Guidelines* of “products that are reasonably interchangeable” is consistent from an economic perspective with *Brown Shoe Co. v. U.S.*, 370 U.S. 294, 325 (1962).

<sup>104</sup> Corb, H. (2012), *Interest Rate Swaps and Other Derivatives*, New York, NY: Columbia University Press, p. xiv.

considered “revolutionary.”<sup>105</sup> Interest rate swaps are widely used because “virtually every business borrows money and is, therefore, exposed to some form of interest rate risk. Even if a business borrows at a fixed rate, changes in interest rates create opportunity costs.”<sup>106</sup>

92. The factors identified by the United States Supreme Court in *Brown Shoe* all indicate the existence of a market for interest rate derivatives. As discussed in that decision, a relevant antitrust product market should be consistent with such “practical indicia as industry or public recognition of the submarket as a separate economic entity, the product’s peculiar characteristics and uses, unique production facilities, distinct customers, distinct prices, sensitivity to price changes, and specialized vendors.”<sup>107</sup> As discussed below, each of these indicia are present in the product market for interest rate derivatives.

93. *The industry itself recognizes a market for interest rate derivatives.* ICAP, for example, states: “ICAP is the leading broker across the entire range of interest rate products, ranging from exotic options to short and long-term interest rate swaps.”<sup>108</sup> Finance textbooks discuss and analyze the market for interest rate derivatives.<sup>109</sup> The dollar value of this market is quite large. As one well-known textbook states: “The aggregate outstanding notional [amount] of over-the-counter (OTC) interest rate swaps and options stood in excess of \$400 trillion by the end of 2010, according to the Bank for International Settlements.”<sup>110</sup>

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<sup>105</sup> Corb, H. (2012), *Interest Rate Swaps and Other Derivatives*, New York, NY: Columbia University Press, p. xiii.

<sup>106</sup> Chance, D. and Brooks, R. (2016), *An Introduction to Derivatives and Risk Management*, 10<sup>th</sup> ed., Boston, MA: Cengage Learning, p. 396.

<sup>107</sup> *Brown Shoe Co. v. U.S.*, 370 U.S. 294, 325 (1962).

<sup>108</sup> ICAP, “Interest Rates,” available at <http://www.icap.com/what-we-do/our-markets-and-products/interest-rates.aspx> (accessed on July 27, 2017).

<sup>109</sup> See, e.g., Chance, D. and Brooks, R. (2016), *An Introduction to Derivatives and Risk Management*, 10<sup>th</sup> ed., Boston, MA: Cengage Learning, Chapters 11-13.

<sup>110</sup> Corb, H. (2012), *Interest Rate Swaps and Other Derivatives*, New York, NY: Columbia University Press, p. xiii.

94. *The peculiar characteristics and uses of interest rate derivatives.* The interest rate derivative market allows for risk to be transferred from one party to another. Derivatives are contracts between two parties that detail the specifics of the risk transfer agreement. The most common interest rate derivative is referred to as a swap. An interest rate swap is an agreement between counterparties to exchange agreed upon cash flows for a period of time. These cash flows can be fixed or floating and are based on an amount commonly referred to as the “notional.”

95. The most common swap is a “vanilla” interest rate swap agreement. In this agreement, one counterparty agrees to pay a fixed rate and in return accepts a series of cash flows based on variable rates. The three-month LIBOR rate is the standard market index utilized to calculate this floating payment. A common example of when this swap is employed occurs when a large corporation issues fixed rate debt. Frequently, corporate treasurers manage their cash flows on a short-term basis and would prefer to make debt payments based on current market rates. A swap agreement allows for a risk transfer, as a treasurer can “swap” her fixed rate payment into a floating rate payment. The owners of the debt still receive their fixed payment from the company, but the swap agreement allows the company to receive the payment it owes the bondholder and in exchange make a floating payment to its swap counterparty. In this example, the swap allows for the fixed interest rate risk to be transferred to a party willing to accept it.

96. *Unique production facilities.* The market for interest rate derivatives uses specialized facilities. For example, traders rely on the Reuters electronic screen service known as the 19901 Screen.<sup>111</sup> As noted by the CFTC: “The 19901 screen is a reference used widely throughout the financial industry by swap dealer banks, hedge funds, asset managers, businesses,

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<sup>111</sup> Screen 19901 is Reuters electronic screen service, which publicized executable bids and offers for interest rate swaps of the specified terms posted at ICAP and the bid/offer rates of all interest rate swaps of the specified terms executed through ICAP and which was updated periodically throughout the day by ICAP as trades were executed.

and other participants in interest rate markets.”<sup>112</sup> As noted by one industry observer: “About 6,000 companies and financial firms subscribe to the prices published on the 19901 screen, according to ICAP. Those values are accepted as a legal settlement price by which swaps traders can terminate contracts or to mark the value of positions, according to ISDA.”<sup>113</sup>

97. *Distinct customer base for interest rate derivatives.* Customers in the market for interest rate derivatives include pension funds, asset managers, insurance companies, hedge funds, government entities, and financial institutions. The reasons why such customers transact in the market for interest rate derivatives are described in a well-known textbook as follows:

Swaps have been one of the greatest success stories in the financial markets of the 1980s and 1990s. Interest rate swaps, for example, are widely used by corporations to manage interest rate risk. As we shall see, corporations often convert floating-rate loans to fixed-rate loans using interest rate swaps. Currency and equity swaps are used far less than interest rate swaps, but they are still important tools for managing currency and equity risk, respectively.<sup>114</sup>

98. *Distinct prices for interest rate derivatives.* Interest rate derivatives in cash-settled swaptions are valued based on the differences in interest rates. For example, a cash-settled swaption is valued by comparing (1) the fixed rate set in the swaption transaction to (2) the market fixed rate for an equivalent swap. The benchmark rate used for the market fixed rate for an equivalent swap is the ISDAfix rate. ISDA has stated: [REDACTED]

[REDACTED]<sup>115</sup> As described by the CFTC:

<sup>112</sup> CFTC, *In the Matter of The Goldman Sachs Group, Inc., and Goldman, Sachs & Co., Order Instituting Proceedings Pursuant to Sections 6(c) and 6(d) of the Commodity Exchange Act, Making Findings, and Imposing Remedial Sanctions* (December 21, 2016), p. 5.

<sup>113</sup> Leising, M. (2013), “CFTC Said Probing ICAP on Swap Price Allegations: Credit Markets,” *Bloomberg*, available at <http://www.bloomberg.com/news/2013-04-09/cftc-said-probing-icapon-swap-price-allegations-credit-markets.html> (accessed on July 27, 2017).

<sup>114</sup> Chance, D. and Brooks, R. (2016), *An Introduction to Derivatives and Risk Management*, 10<sup>th</sup> ed., Boston, MA: Cengage Learning, p. 396.

<sup>115</sup> BNPP\_AK\_00000885-88, at 85.



The 11:00 am USD ISDAFIX rate is used for cash settlement of options on interest rate swaps, or swaptions, and as a valuation tool for certain other interest rate products. For example, USD ISDAFIX was used during the Relevant Period in settlement of interest rate swap futures contracts traded on the Chicago Mercantile Exchange (“CME”) and as a component in the calculation of various proprietary interest rate indices and structured products. At times, the USD ISDAFIX was used in the pricing of debt issuances.<sup>116</sup>

99. *Sensitivity to price changes for interest rate derivatives.* Market participants recognize the importance of small changes in interest rates on the value of interest rate derivatives.

For example, a UBS email dated September 7, 2011 states: [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]<sup>117</sup> As noted in an article in the *Financial Times*:

The nature of swap trading means a small difference in pricing does matter given the large notional size of trades that can start at \$100m and rise to \$1bn and more between banks and their clients. In this world, a hundredth of a percentage point matters. A difference of a quarter or half a tick in a fixing is very important. For example, for a \$100m 10-year swap trade, each basis point change amounts to a plus or gain of about \$93,000.<sup>118</sup>

100. Similarly, an October 9, 2008 BNPP internal communication discusses the fact that

[REDACTED]

[REDACTED]:

[REDACTED]

<sup>116</sup> CFTC, *In the Matter of The Royal Bank of Scotland plc, Order Instituting Proceedings Pursuant to Sections 6(c) and 6(d) of the Commodity Exchange Act, Making Findings, and Imposing Remedial Sanctions* (February 3, 2017), p. 2.

<sup>117</sup> AK\_UBS\_0010701-706, at 701.

<sup>118</sup> Mackenzie, M., Braithwaite, T., and Scannell, K. (2013), “Swap traders’ morning fix under scrutiny,” *Financial Times*, available at <http://www.ft.com/intl/cms/s/0/ddbebb32-a11d-11e2-bae1-00144feabdc0.html#axzz2x74uiRT6> (accessed on July 27, 2017).

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101. *Specialized vendors for interest rate derivatives.* ISDA and ICAP are specialized vendors in the market for interest rate derivatives.

102. ISDA describes itself as follows:

Since 1985, the International Swaps and Derivatives Association has worked to make the global derivatives markets safer and more efficient.

ISDA's pioneering work in developing the ISDA Master Agreement and a wide range of related documentation materials, and in ensuring the enforceability of their netting and collateral provisions, has helped to significantly reduce credit and legal risk. The Association has been a leader in promoting sound risk management practices and processes, and engages constructively with policymakers and legislators around the world to advance the understanding and treatment of derivatives as a risk management tool.<sup>120</sup>

103. ICAP describes itself as follows: "ICAP is the world's premier voice and electronic interdealer broker and the source of global market information and commentary for professionals in the international financial markets."<sup>121</sup> ICAP further states that, in 2009, it "has an average daily transaction volume in excess of \$2.3 trillion"<sup>122</sup> In 2012, ICAP stated its focus is on "remaining number one in the industry."<sup>123</sup>

B. *Relevant geographic market*

104. A relevant antitrust geographic market has been defined as "the market area in which the seller operates, and to which the purchaser can practicably turn for supplies."<sup>124</sup> A

<sup>119</sup> BNPP\_AK\_00058471-75, at 71.

<sup>120</sup> ISDA, "About ISDA," available at <http://www2.isda.org/about-isda/> (accessed on July 27, 2017).

<sup>121</sup> ICAP, *2007 Annual Report*, at 2, available at <http://www.icap.com/~media/Files/I/Icap-Corp/Annual%20Reports/annual-report2007.pdf> (accessed on July 27, 2017).

<sup>122</sup> ICAP, *2009 Annual Report*, at 2, available at <http://www.icap.com/~media/Files/I/Icap-Corp/Annual%20Reports/annual-report2009.pdf> (accessed on July 27, 2017).

<sup>123</sup> ICAP, *2012 Annual Report*, at 11, available at <http://www.icap.com/~media/Files/I/Icap-Corp/Annual%20Reports/annual-report2012.pdf> (accessed on July 27, 2017).

<sup>124</sup> *Tampa Electric Co. v. Nashville Coal Co.*, 365 U.S. 320, 328 (1961).

relevant geographic market has been said to “‘correspond to the commercial realities’ of the industry and be economically significant.”<sup>125</sup> In the present case, the relevant geographic market is worldwide.

105. The ability of firms to execute trades rapidly on a worldwide basis, coupled with powerful profit incentives, creates arbitrage conditions that reduce or eliminate any regional differences in interest rates used in financial derivative instruments. As noted by ISDA: “Since 1985, the International Swaps and Derivatives Association has worked to make the global derivatives markets safer and more efficient.”<sup>126</sup>

C. *Direct evidence of market power*

106. There is a growing consensus among experts in industrial organization and antitrust economics that market definition is unnecessary in cases where direct evidence of firms’ market power exists. For example, Professor Baker explains:

[M]arket definition may not be required when market power or anticompetitive effect can be demonstrated directly through means other than inference from the number, size distribution, and other characteristics of firms. Market definition is least useful when market shares would not be strongly probative of market power or anticompetitive effect, while direct evidence as to market power or anticompetitive effect is available and convincing.<sup>127</sup>

107. In the present case, the alleged agreement caused increases in payments from counterparty class members or decreases in payments to counterparty class members, because of

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<sup>125</sup> *Brown Shoe Co. v. U.S.*, 370 U.S. 294, 336-37 (1962), quoting from *American Crystal Sugar Co. v. Cuban-American Sugar Co.*, 152 F.Supp. 387, 398 (D.C.S.D.N.Y.), *aff’d*, 259 F.2d 524 (C.A.2d Cir.); S.Rep. No. 1775, 81st Cong., 2d Sess. 5-6 (footnotes omitted).

<sup>126</sup> ISDA, “About ISDA,” available at <http://www2.isda.org/about-isda/> (accessed on July 27, 2017).

<sup>127</sup> Baker, J. (2007), “Market Definition: An Analytical Overview,” *Antitrust Law Journal*, vol. 74, pp. 129-173, at 131 (footnotes omitted). See also Baker, J. and Bresnahan, T. (2008), “Economic Evidence in Antitrust: Defining Markets and Measuring Market Power,” in *Handbook of Antitrust Economics* (P. Buccirossi ed.), Cambridge, MA: The MIT Press, pp. 1-42, at 15: “Historically, in the antitrust world, market power has most commonly been identified through inference from a high market share. But direct evidence has increasingly become important as an alternative, in part because academic economists have developed a number of econometric approaches for measuring market power.”

the cumulative effect of Defendants' rubberstamping and bang-the-fix actions.<sup>128</sup> Based on these findings, which are common to the proposed class, Dr. Pirrong concludes that Defendants' alleged conduct negatively impacted many Class Members. This is an example of a "natural experiment" as described in the *Horizontal Merger Guidelines*. This demonstrated ability to cause interest rates to differ from what they would have been but-for a price-fixing agreement shows that Defendants exercised market power, and this finding neither relies on nor requires a definition of the relevant market.

## V. CONCLUSIONS

108. There is a relevant product market for USD-denominated interest rate derivatives. The relevant geographic market is worldwide.

109. Well-accepted economic methodologies and common evidence support the allegation that Defendants conspired to rig ISDAfix rates. In particular, Defendant Banks rubber stamped the ICAP Reference Rate on almost every day until late 2012. Such unanimous submissions, as well as their dissipation after late 2012, cannot be explained by market factors. Defendant Banks' rubber-stamped submissions were against their unilateral interests in the absence of an agreement. The ICAP Reference Rate served as a focal point for coordination among Defendant Banks with respect to their USD ISDAfix submissions, facilitating their ability to manipulate ISDAfix by banging the close without extensive direct communications on a daily basis.

110. In addition, Defendant Banks' banging the close activities provide common evidence of actions against their self-interests but for the existence of an agreement. Dr. Pirrong's

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<sup>128</sup> Pirrong Expert Report, Sections V-VIII.

expert report demonstrates that, as a result of Defendants' conduct, actual interest rates differed from but-for benchmark interest rates in the proposed Class Period.

111. I conclude that there exist well-accepted economic methodologies and common evidence from which a fact-finder could determine the existence of an agreement to rig ISDAfix rates, i.e., that Defendants entered into a conspiracy to rig ISDAfix rates.

July 28, 2017



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Michael A. Williams

**HIGHLY CONFIDENTIAL**

## APPENDIX I: RESUME

**MICHAEL A. WILLIAMS**

I am a Director at Competition Economics, LLC. I specialize in analyses involving antitrust, industrial organization, and regulation. I have published articles in a number of academic journals, including the *American Economic Review*, *Proceedings of the National Academy of Sciences*, *Journal of Industrial Economics*, *International Journal of Industrial Organization*, *Journal of Law and Economics*, *American Law and Economics Review*, *Journal of Economics and Management Strategy*, *Review of Industrial Organization*, *Journal of Institutional and Theoretical Economics*, *Economics Letters*, *Journal of Public Economic Theory*, *Behavioral Science*, *Antitrust Bulletin*, *Physica A*, *Texas Law Review*, and *Yale Journal on Regulation*.

I have provided written and/or oral testimony before:

- United States District Court, Middle District of Alabama
- United States District Court, Central and Northern Districts of California
- United States District Court, District of Delaware
- United States District Court, Northern District of Georgia
- United States District Court, Eastern Division, District of Idaho
- United States District Court, District of Kansas
- United States District Court, District of Massachusetts
- United States District Court, District of Minnesota
- United States District Court, District of New Jersey
- United States District Court, Southern District of New York
- United States District Court, Eastern District of Pennsylvania
- United States District Court, Eastern District of Tennessee
- United States District Court, Northern and Southern Districts of Texas
- United States Court of Federal Claims
- State of Connecticut, Superior Court
- State of New Mexico, Second Judicial District

- State of Nevada, Gaming Commission and State Gaming Control Board
- Public utilities commissions: Arkansas, Hawaii, Michigan, Minnesota, Missouri, Nebraska, New Mexico, Texas, and Washington

I have been retained as an economic consultant by the U.S. Department of Justice, Antitrust Division, the U.S. Federal Trade Commission, and the Canadian Competition Bureau.

Previously, I was an economist with the U.S. Department of Justice, Antitrust Division. I hold a B.A. degree in economics from the University of California, Santa Barbara, and I receive my M.A. and Ph.D. degrees in economics from the University of Chicago.

#### **TESTIMONY AND EXPERT REPORTS (PAST FOUR YEARS)**

UNITED STATES DISTRICT COURT, CENTRAL DISTRICT OF CALIFORNIA  
Bahamas Surgery Center, LLC, Rep et al. v. Kimberly-Clark Corporation and Halyard Health, Inc.  
Expert report and trial testimony regarding class certification and damages, 2017.

UNITED STATES DISTRICT COURT, CENTRAL DISTRICT OF CALIFORNIA  
Hrayr Shahinian, M.D., F.A.C.S., et al. v. Kimberly-Clark Corporation and Halyard Health, Inc.  
Expert reports regarding class certification and damages, 2016.

UNITED STATES DISTRICT COURT, SOUTHERN DISTRICT OF NEW YORK  
In Re Aluminum Warehousing Antitrust Litigation  
Expert declaration regarding antitrust claims (filed under seal), 2016.

UNITED STATES DISTRICT COURT, NORTHERN DISTRICT OF CALIFORNIA  
BNSF Railway Company and Union Pacific Railroad Company v. California State Board of Equalization, et al.  
Expert declaration regarding effects of California Senate Bill 84, 2016.

UNITED STATES DISTRICT COURT, CENTRAL DISTRICT OF CALIFORNIA  
Zenith Electronics, LLC, Panasonic Corporation, and U.S. Phillips Corporation v. Sceptre, Inc.  
Expert reports and deposition regarding antitrust claims (filed under seal), 2015-2016.

UNITED STATES DISTRICT COURT, DISTRICT OF MINNESOTA  
The Valspar Corporation and Valspar Sourcing, Inc. v. Millennium Inorganic Chemicals, et al.  
Expert reports and depositions regarding antitrust claims (filed under seal), 2014-2015.

UNITED STATES DISTRICT COURT, DISTRICT OF IDAHO  
In Re Fresh and Process Potatoes Antitrust Litigation  
Expert report regarding antitrust claims (filed under seal), 2013-2015.

UNITED STATES DISTRICT COURT, DISTRICT OF MASSACHUSETTS

Kirk Dahl, et al., v. Bain Capital Partners, LLC, et al.

Expert reports and deposition regarding antitrust claims (filed under seal), 2012-2014.

UNITED STATES DISTRICT COURT, EASTERN DISTRICT OF PENNSYLVANIA

Caroline Behrend, et al. v. Comcast Corporation, Civil Action No. 03-6604

Expert reports, deposition, and trial testimony on class certification and antitrust claims, 2009-2014.

STATE OF NEW MEXICO, SECOND JUDICIAL DISTRICT

Guidance Endodontics, LLC and Dr. Charles Goodis v. Modrall, Sperling, Harris & Sisk, P.A.,  
Olshan, Grundman, Frome, Rosenzweig & Wolosky, LLP

Expert report and deposition regarding damages claims, 2012-2013.

UNITED STATES DISTRICT COURT, DISTRICT OF NEW JERSEY

TransWeb, LLC v. 3M Innovative Properties Company and 3M Company

Expert report and deposition regarding antitrust claims (filed under seal), 2012.

UNITED STATES DISTRICT COURT, CENTRAL DISTRICT OF CALIFORNIA

In Re: Toyota Motor Corp. Hybrid Brake Marketing, Sales Practices, and Products Liability  
Litigation

Expert reports and depositions regarding class certification and damages, 2012.

UNITED STATES DISTRICT COURT, EASTERN DISTRICT OF TENNESSEE

ICare-EMS, Inc. v. Rural/Metro Corp.

Expert reports and depositions regarding antitrust claims, 2012.

UNITED STATES DISTRICT COURT, MIDDLE DISTRICT OF FLORIDA

In Re: Disposable Contact Lens Antitrust Litigation

Expert report and deposition testimony regarding class certification and damages, 2017

**PUBLICATIONS**

“The OPEC of Potatoes: Should Collusive Agricultural Production Restrictions Be Immune From Antitrust Law Enforcement?,” *Virginia Law & Business Review* (2017), vol. 11, pp. 399-450 (with Melanie Stallings Williams and Wei Zhao).

“Global Evidence on the Distribution of GDP Growth Rates,” *Physica A* (2017), vol. 468, pp. 750-758 (with Grace Baek, Yiyang Li, Leslie Y. Park, and Wei Zhao).

“What is a But-For World?,” *Antitrust* (2016), vol. 31, pp. 102-108 (with Justine S. Hastings).

“The Business of American Democracy: *Citizens United*, Independent Spending, and Elections,” *Journal of Law and Economics* (2016), vol. 59, pp. 1-43 (with Tilman Klumpp and Hugo M. Mialon) (lead article).



“Global Evidence on the Distribution of Economic Profit Rates,” *Physica A* (2016), vol. 458, pp. 356-363 (with Grace Baek, Leslie Y. Park and Wei Zhao).

“Fraud Cycles,” *Journal of Institutional and Theoretical Economics* (2016), vol. 172, pp. 544-572 (with R. Preston McAfee and Jiong Gong).

“Counterintuitive Signs in Reduced Form Price Regressions,” *ABA Economics Committee Newsletter* (2016), vol. 16, pp. 7-19 (with Yonghong An and Wei Zhao) (lead article).

“Brief of Economists and Other Social Scientists as Amici Curiae in Support of Respondents,” *Tyson Foods, Inc. v. Peg Bouaphakeo, et al.*, U.S. Supreme Court No. 14-1146, September 29, 2015. Cited in Opinion of the Court, 577 U.S. \_\_\_\_ (2016).

“Leveling the Playing Field? The Role of Public Campaign Funding in Elections,” *American Law and Economics Review* (2015), vol. 17, pp. 361-408 (with Tilman Klumpp and Hugo M. Mialon) (lead article) (awarded 2015 Distinguished Article Prize).

“Global Evidence on the Distribution of Firm Growth Rates,” *Physica A* (2015), vol. 432, pp. 102-107 (with Brijesh P. Pinto and David Park).

“The Deterrent Effect of Cable System Clustering on Overbuilders: An Economic Analysis of *Behrend v. Comcast*,” *Economics Bulletin* (2015), vol. 35, pp. 519-527 (with Philip J. Reny).

“Auctions and Bid Rigging,” in *Oxford Handbook on International Antitrust Economics* (2015), vol. 2, eds. Roger D. Blair and D. Daniel Sokol, Oxford University Press, Chapter 20, pp. 498-522 (with Ken Hendricks and R. Preston McAfee).

“Evaluating Big Deal Journal Bundles,” *Proceedings of the National Academy of Sciences* (2014), vol. 111, no. 26, pp. 9425-9430 (with Theodore C. Bergstrom, Paul N. Courant, and R. Preston McAfee).

Book Review, *Cartels, Competition and Public Procurement. Law and Economics Approaches to Bid Rigging*, by Stefan E. Weishaar, *Journal of Economic Literature* (2014), vol. 52, pp. 548-549 (with Brijesh P. Pinto).

“Oracle’s Acquisition of PeopleSoft: *U.S. v. Oracle*,” in *The Antitrust Revolution: Economics, Competition, and Policy* (2014), eds. John E. Kowka and Lawrence J. White, Oxford University Press, 6<sup>th</sup> ed. (with R. Preston McAfee and David S. Sibley).

“Predatory Hiring as Exclusionary Conduct: A New Perspective,” *Pepperdine Journal of Business, Entrepreneurship, and the Law* (2013), vol. 7, pp. 1-25 (with Richard L. Braun) (lead article).

“Tax Incidence Under Imperfect Competition: Comment,” *International Journal of Industrial Organization* (2012), vol. 30, pp. 399-402 (with Philip J. Reny and Simon J. Wilkie) (lead article).

“China’s Anti-Monopoly Law: What is the Welfare Standard?,” *Review of Industrial Organization* (2012), vol. 41, pp. 31-52 (with Pingping Shan, Guofu Tan, and Simon J. Wilkie).

“Estimating Monopoly Power with Economic Profits,” *UC Davis Business Law Journal* (2010), vol. 10, pp. 125-150 (with Kevin Kreitzman, Melanie Stallings Williams, and William M. Havens).

Book Review, *Truth or Economics: On the Definition, Prediction, and Relevance of Economic Efficiency*, by Richard S. Markovits, *Journal of Economic Literature* (2009), vol. 47, pp. 1133-1135.

“Interpreting Concentration Indices in the Secondary Market for Natural Gas Transportation: The Implication of Pipeline Residual Rights,” *Energy Economics* (2008), vol. 30, pp. 807-817 (with Michael J. Doane, R. Preston McAfee, and Ashish Nayyar).

“Evaluating the Likely Competitive Effects of Horizontal and Vertical Mergers: A New Approach,” *Antitrust Report* (2007) Issue 2, pp. 33-40 (with Ken Hendricks and R. Preston McAfee).

“Report on Petroleum Products Markets in the Northeast,” prepared for the Attorneys General of Maine, Massachusetts, New Hampshire, New York, and Vermont (2007) (with Justine S. Hastings and Michael L. Mitton).

“Assigning Market Shares in Technology Markets: Why 1/N is Rarely the Right Answer,” *ABA Economics Committee Newsletter* (2006) vol. 6, pp. 11-16 (with Ashish Nayyar).

“Evaluating and Enhancing Competition in the Interstate Natural Gas Transportation Industry,” *Natural Resources Journal* (2004) vol. 44, pp. 761-808 (with Michael J. Doane and R. Preston McAfee).

“Pricing Access to a Monopoly Input,” *Journal of Public Economic Theory* (2004) vol. 6, pp. 541-555 (with David S. Sibley, Michael J. Doane, and Shu-Yi Tsai).

“What is a Barrier to Entry?,” *American Economic Review* (2004) vol. 94, pp. 461-465 (with R. Preston McAfee and Hugo Mialon).

*Deregulation of Entry in Long-Distance Telecommunications* (2002), Institute of Public Utilities, Michigan State University (with Paul W. MacAvoy).

“The Costs and Benefits of Long-Distance Entry: Regulation and Non-Price Discrimination,” *Review of Industrial Organization* (2001) vol. 18, pp. 275-282 (with Dennis L. Weisman).

“Measuring Anticompetitive Effects of Mergers When Buyer Power is Concentrated,” *Texas Law Review*, (2001) vol. 79, no. 6, pp. 1621-1639 (with Ken Hendricks, Joshua M. Fried, R. Preston McAfee, and Melanie Stallings Williams).

“Collusive Bidding in the Market for Corporate Control,” *Nebraska Law Review*, (2000) vol. 79, no. 1, pp. 48-74 (with Joshua M. Fried, R. Preston McAfee, and Melanie Stallings Williams).

“Having Your Cake—How to Preserve Universal-Service Cross Subsidies While Facilitating Competitive Entry,” *Yale Journal on Regulation*, (1999) vol. 16, no. 2, pp. 311-326 (with Michael J. Doane and David S. Sibley).

“Four Decades of Regulatory Reform of the Gas Industry,” *Oil & Gas Tax Quarterly*, (1996) vol. 45, no. 31-58 (with Paul W. MacAvoy and Michael J. Doane).

“Software Mergers: An Economic Perspective,” *American Bar Association, Computer Industry Committee*, (1995) vol. 2, no. 3, pp. 7-9.

“Competitive Entry into Regulated Monopoly Services and the Problem of Stranded Costs,” *Hume Papers on Public Policy*, (1995) (with Michael J. Doane).

“Collusive Bidding in Hostile Takeovers,” *Journal of Economics and Management Strategy*, (1993) vol. 2, no. 4, pp. 449-482, (with R. Preston McAfee, Daniel Vincent, and Melanie Williams Havens).

“The Renaissance of Market Definition,” *The Antitrust Bulletin*, (1993) vol. 38, no. 4, pp. 799-857, (with Joseph J. Simons).

“Horizontal Mergers in Spatially Differentiated Noncooperative Markets,” *Journal of Industrial Economics*, (1992) vol. 40, no. 4, pp. 349-358, (with R. Preston McAfee and Joseph J. Simons) (lead article).

“Recent Developments in Economic Theory Regarding the Competitive Effects of Horizontal Mergers,” *International Merger Law* (1992) (with R. Preston McAfee).

“Horizontal Mergers and Antitrust Policy,” *Journal of Industrial Economics*, (1992) vol. 40, no. 2, pp. 181-188 (with R. Preston McAfee).

“New U.S. Merger Enforcement Guidelines: Competitive Effects,” *International Merger Law*, (1992) no. 21, pp. 6-9 (with R. Preston McAfee and Joseph J. Simons).

“On What Economic Grounds Should Horizontal Mergers Be Challenged?,” *International Merger Law*, (1991) no. 7, pp. 16-18 (with R. Preston McAfee).

“Why Did So Many Savings and Loans Go Bankrupt?,” *Economics Letters*, (1991) vol. 36, no. 1, pp. 61-66 (with Harindra de Silva, Michael F. Koehn, and Stanley I. Ornstein).

“Consumer Welfare Loss: The Unawarded Damages in Antitrust Suits,” *University of Dayton Law Review*, (1990) vol. 15, no. 3, pp. 457-470 (with Melanie Williams Havens and Michael F. Koehn).

“Concentration, Potential Entry, and Performance in the Airline Industry,” *Journal of Industrial Economics*, (1989) vol. 38, no. 2, pp. 119-139 (with Gloria J. Hurdle, Richard L. Johnson, Andrew S. Joskow, and Gregory J. Werden) (lead article).

“The Department of Justice Merger Guidelines: A Critique and a Proposed Improvement,” *Pepperdine Law Review*, (1989) vol. 16, no. 4, pp. 1069-1081 (with R. Preston McAfee).

“Can the Concentration-Collusion Hypothesis Be Refuted Empirically?,” *Economics Letters*, (1989) vol. 30, no. 3, pp. 253-257 (with Gregory J. Werden).

“The Role of Stock Market Studies in Formulating Antitrust Policy Toward Horizontal Mergers,” *Quarterly Journal of Business and Economics*, (1989) vol. 28, no. 4, pp. 3-21 (with Gregory J. Werden).

“The Role of Stock Market Studies in Formulating Antitrust Policy Toward Horizontal Mergers: Reply,” *Quarterly Journal of Business and Economics*, (1989) vol. 28, no. 4, pp. 39-42 (with Gregory J. Werden).

“Can Event Studies Detect Anticompetitive Mergers?,” *Economics Letters*, (1988) vol. 28, no. 2, pp. 199-203 (with R. Preston McAfee).

“An Empirical Test of Cooperative Game Solution Concepts,” *Behavioral Science*, (1988) vol. 33, no. 3, pp. 224-237.

“Output-Inflation Tradeoffs in 34 Countries: Comment,” *Journal of Economics and Business*, (1988) vol. 40, no. 1, pp. 97-101 (with Michael G. Baumann).

“Explaining and Predicting Airline Yields With Nonparametric Regression Trees,” *Economics Letters*, (1987) vol. 24, no. 1, pp. 99-105 (with Andrew S. Joskow, Richard L. Johnson, and Gloria J. Hurdle).

“Rankings of Economics Departments By Field,” *American Economist*, (1987) vol. 31, no. 1, pp. 56-61 (with Michael G. Baumann and Gregory J. Werden).

“International Evidence on Output-Inflation Tradeoffs: A Bootstrap Analysis,” *Economics Letters*, (1986) vol. 21, no. 2, pp. 149-153 (with Michael G. Baumann).

“An Economic Application of Bootstrap Statistical Methods: Addyston Pipe Revisited,” *American Economist* (1986) vol. 30, no. 2, pp. 52-58.

“Bootstrap Statistical Analysis of Time-Series Regressions,” *SAS Communications*, (1986) vol. 11, no. 3 (with Michael G. Baumann).

“On the Demise of the Telephone Network and Why It Happened,” *Public Utilities Fortnightly*, (1986) vol. 118, no. 5, p. 6.

## **U.S. DEPARTMENT OF JUSTICE REPORTS (CONTRIBUTOR)**

Reply Comments of the U.S. Department of Justice Before the Federal Communications Commission, “Policy and Rules Concerning Rates for Dominant Carriers,” Docket No. 87-313, December 11, 1987.

Comments of the U.S. Department of Justice Before the Federal Communications Commission, “The Bell Atlantic Telephone Companies’ Offer of Comparably Efficient Interconnection to Enhanced Service Providers,” Docket No. 85-229, June 15, 1987.

Comments of the U.S. Department of Justice Before the Federal Communications Commission, “Decreased Regulation of Certain Basic Telecommunications Services,” Docket No. 86-421, March 6, 1987.

Comments of the U.S. Department of Justice Before the Securities and Exchange Commission, “Self-Regulatory Organizations: Proposed Rule Change by New York Stock Exchange, Inc. Relating to Amendments to the Exchange’s Voting Rights Listing Standards for Domestic Companies,” File No. SR-NYSE-86-17, December 5, 1986.

Comments of the U.S. Department of Justice Before the Securities and Exchange Commission, “Concept Release on Takeovers and Contests for Corporate Control,” File No. 57-18-86, October 17, 1986.

Comments of the U.S. Department of Justice Before the Federal Communications Commission, “Amendment of Section 64.702 of the Commission’s Rules and Regulations (Third Computer Inquiry),” Docket No. 85-229 Phase II, August 8, 1986.

Comments of the U.S. Department of Justice Before the Federal Communications Commission, “Separation of Costs of Nonregulated Activities,” Docket No. 86-111, July 30, 1986.

Comments of the U.S. Department of Justice Before the United States Postal Service, “Restrictions on Private Carriage of Letters; Proposed Suspension of the Private Express Statutes; International Remailing,” July 17, 1986.

Comments of the U.S. Department of Justice Before the Federal Communications Commission, “Separation of Costs of Regulated Telephone Service From Costs of Nonregulated Activities,” Docket No. 86-111, June 30, 1986.

Comments of the U.S. Department of Justice Before the United States Postal Service, “International Priority Airmail Service,” June 9, 1986.

Comments of the U.S. Department of Justice Before the United States Postal Service, “Restrictions on Private Carriage of Letters; Proposed Clarification and Modification of Definition and of Regulations on Extremely Urgent Letters,” December 12, 1985.

Notice of Intervention of the U.S. Department of Justice as a Limited Participator and Opposition to USPS Motion for Waiver, “Destination–BMC Parcel Post Classification and Rate Changes (Experiment),” November 22, 1985.

Comments of the U.S. Department of Justice Before the Federal Communications Commission, “Investigation of Access and Divestiture Related Tariffs,” Docket No. 83-1145, April 8, 1985.

## **U.S. DEPARTMENT OF JUSTICE CASES**

### **MERGER INVESTIGATIONS**

General Electric Company’s acquisition of RCA.

Westwood One, Inc.’s acquisition of NBC Radio.

Turner Broadcasting System, Inc.’s attempted acquisition of CBS.

Norfolk Southern, Inc.’s acquisition of North American Van Lines.

Cooper Industries, Inc.’s acquisition of Westinghouse Electric, Corp.’s Lighting Fixture Business.

Southwestern Public Service Company’s acquisition of New Mexico Electric Service Company.

ITT-Continental Baking Company’s acquisition of Bost Bakery, Inc.

Williams Companies’ acquisition of Northwest Energy, Corp.

Archer-Daniel-Midland’s acquisition of Gold Kist’s Valdosta, Georgia soybean processing plant.

### **PRICE FIXING**

United States of America v. Weeks Marine, Inc.

### **CONSENT DECREES**

United States of America v. Wallpaper Institute

United States of America v. Greyhound, Corp.

United States of America v. Balley Manufacturing, Corp.

APPENDIX II: DOCUMENTS RELIED UPON

**Academic Articles/Books**

ABA Section of Antitrust Law (2010), *Proof of Conspiracy Under Federal Antitrust Laws*

ABA Section of Antitrust Law (2012), *Antitrust Law Developments*, 7th ed.

Baker, J. (2007), “Market Definition: An Analytical Overview,” *Antitrust Law Journal*, vol. 74, pp. 129-173

Baker, J. and Bresnahan, T. (2008), “Economic Evidence in Antitrust: Defining Markets and Measuring Market Power,” in *Handbook of Antitrust Economics* (P. Buccirossi ed.), Cambridge, MA: The MIT Press, pp. 1-42

Belleflame, P. and Peitz, M. (2015), *Industrial Organization: Markets and Strategies*, Cambridge University Press

Carlton, D. and Perloff, J. (2005), *Modern Industrial Organization*, 4th ed., Boston, MA: Pearson Addison-Wesley

Chance, D. and Brooks, R. (2016), *An Introduction to Derivatives and Risk Management*, 10th ed., Boston, MA: Cengage Learning

Church, J. and Ware, R. (2000), *Industrial Organization: A Strategic Approach*, Boston, MA: Irwin McGraw-Hill

Corb, H. (2012), *Interest Rate Swaps and Other Derivatives*, New York, NY: Columbia University Press

Kovacic, W., Marshall, R., Marx, L., and White, H. (2011), “Plus Factors and Agreement in Antitrust Law,” *Michigan Law Review*, vol. 110, pp. 393-436

Myerson, R. (2009), “Learning from Schelling’s Strategy of Conflict,” *Journal of Economic Literature*, vol. 47, pp. 1109-1125

Schelling, T. (1980), *The Strategy of Conflict*, Cambridge, MA: Harvard University Press.

Schmalensee, R. (1987), “Standards for Dominant Firm Conduct: What Can Economics Contribute?” in *The Economics of Market Dominance* (D. Hay and J. Vickers, eds.), Oxford: Basil Blackwell, pp. 61-88

Werden, G. (1992), “Four Suggestions on Market Delineation,” *Antitrust Bulletin*, vol. 37, pp. 107-121



**Bates Numbered Documents**

AK_UBS_0010701-706	icap_12341_20080102_0009
BARC-IFX_00006704	icap_12341_20080102_0010
BARC-IFX_00007138	icap_12341_20080102_0011
BARC-IFX_00007185	icap_12341_20080102_0012
BARC-IFX_00007401-402	icap_12341_20080102_0013
BARC-IFX_00011635-36	icap_12341_20080102_0014
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BNPP_AK_00000979-92	icap_12343_20070102_5542_0002
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BNPP_AK_00058133-35	icap_12343_20070102_5542_0004
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Citi-ISDAFIX-Civil-00025956-58	icap_12343_20070102_5542_0010
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ISDAFIX-0017760-61

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JPMC-ISDA00064674-76

MS-ALASKA00018093

MS-ALASKA01712320-21

RBS-Alaska-ISDA-001110364-68

**HIGHLY CONFIDENTIAL**

**Depositions and Exhibits**

Deposition of Andre Leger (June 5, 2017)  
Deposition of Bruce Reid (June 8, 2017)  
Deposition of Catherine Farrer (April 6, 2017)  
Deposition of John D. Rhoten (March 27, 2017)  
Deposition of Lawrence List (June 27, 2017)  
Deposition of Loai Alzubi (April 4, 2017)  
Deposition of Nicholas Farr (January 27, 2017)  
Deposition of Robert G. Pickel (June 7, 2017)  
High Exhibit 3B (Barc-IFX\_00007206)

**Expert Reports**

Expert Report of Craig Pirrong, Ph. D. (July 28, 2017)  
Expert Report of Robert Farrell (July 28, 2017)

**Pleadings, Submissions, Complaints, and Orders**

“ICM’s Responses to Technical Data Questions,” provided by Counsel for ICAP to Counsel for Plaintiffs (June 5 & 21, 2017)

CFTC, *In the Matter of Barclays PLC, Barclays Bank PLC, and Barclays Capital Inc., Order Instituting Proceedings Pursuant to Sections 6(c) and 6(d) of the Commodity Exchange Act, Making Findings, and Imposing Remedial Sanctions* (May 20, 2015)

CFTC, *In the Matter of Citibank, N.A., Order Instituting Proceedings Pursuant to Sections 6(c) and 6(d) of the Commodity Exchange Act, Making Findings, and Imposing Remedial Sanctions* (May 25, 2016)

CFTC, *In the Matter of The Goldman Sachs Group, Inc., and Goldman, Sachs & Co., Order Instituting Proceedings Pursuant to Sections 6(c) and 6(d) of the Commodity Exchange Act, Making Findings, and Imposing Remedial Sanctions* (December 21, 2016)

CFTC, *In the Matter of The Royal Bank of Scotland plc, Order Instituting Proceedings Pursuant to Sections 6(c) and 6(d) of the Commodity Exchange Act, Making Findings, and Imposing Remedial Sanctions* (February 3, 2017)

**Other**

“ICE Benchmark Administration Completes ISDAfix Transition,” *Intercontinental Exchange* (2014), available at <http://ir.theice.com/press/press-releases/all-categories/2014/08-04-2014>

Bloomberg - USD ICE Swap rates.xlsx

*Brown Shoe Co. v. U.S.*, 370 U.S. 294 (1962)

Finch, G. (2014), “ISDA Puts Out to Tender Role of ISDAFIX Benchmark Administrator,” *Bloomberg*, available at [www.bloomberg.com/news/2014-02-24/isda-puts-out-to-tenderrole-of-ISDAFIX-benchmark-administrator.html](http://www.bloomberg.com/news/2014-02-24/isda-puts-out-to-tenderrole-of-ISDAFIX-benchmark-administrator.html)

U.S. Department of Justice and the Federal Trade Commission, *Horizontal Merger Guidelines* (August 19, 2010)

ICAP, “Interest Rates,” available at <http://www.icap.com/what-we-do/our-markets-and-products/interest-rates.aspx>

ICAP, 2007 Annual Report, available at <http://www.icap.com/~media/Files/I/Icap-Corp/Annual%20Reports/annual-report2007.pdf>

ICAP, 2009 Annual Report, available at <http://www.icap.com/~media/Files/I/Icap-Corp/Annual%20Reports/annual-report2009.pdf>

ICAP, 2012 Annual Report, available at <http://www.icap.com/~media/Files/I/Icap-Corp/Annual%20Reports/annual-report2012.pdf>

*In re Elec. Books Antitrust Litig.*, 859 F. Supp. 2d 671 (S.D.N.Y. 2012)

ISDA USD fixing 11am.xlsx

ISDA, “About ISDA,” available at <http://www2.isda.org/about-isda/>

Leising, M. (2013), “CFTC Said Probing ICAP on Swap Price Allegations: Credit Markets,” *Bloomberg*, available at <http://www.bloomberg.com/news/2013-04-09/cftc-said-probing-icap-on-swap-price-allegations-credit-markets.html>

Mackenzie, M., Braithwaite, T., and Scannell, K. (2013), “Swap traders’ morning fix under scrutiny,” *Financial Times*, available at <http://www.ft.com/intl/cms/s/0/ddbebb32-a11d-11e2-bae1-00144feabdc0.html#axzz2x74uiRT6>

Stafford, P. (2015), “ICE to Change Isdafix Calculation,” *Financial Times*, available at [www.ft.com/intl/cms/s/0/e778d3d6-a56e-11e4-ad35-00144feab7de.html#axzz3QGnQh9M8](http://www.ft.com/intl/cms/s/0/e778d3d6-a56e-11e4-ad35-00144feab7de.html#axzz3QGnQh9M8)

*Tampa Electric Co. v. Nashville Coal Co.*, 365 U.S. 320, 328 (1961)

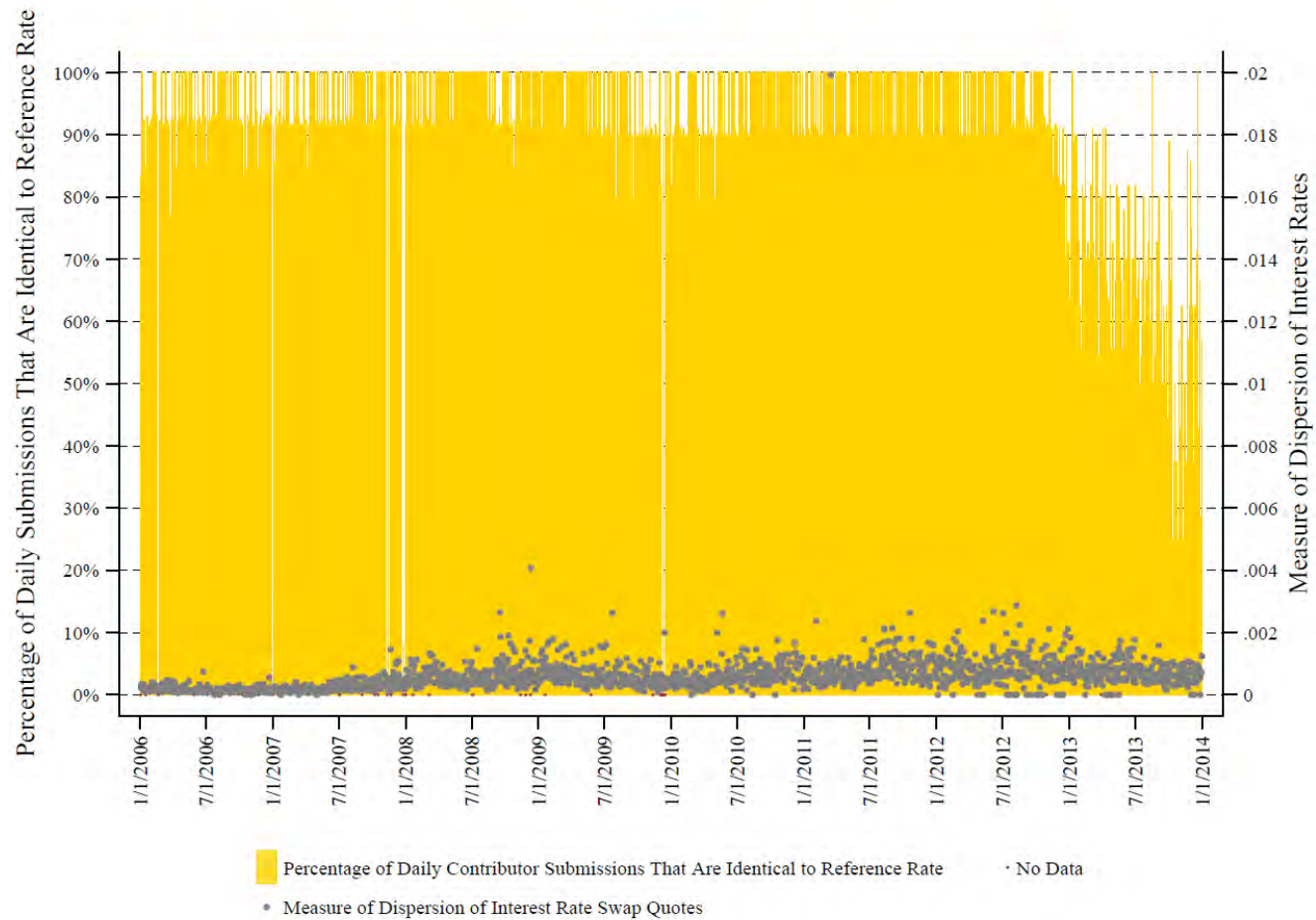
Time and Date.com, “Clock Changes in London, England, United Kingdom,” available at <https://www.timeanddate.com/time/change/uk/london>

Time and Date.com, “Clock Changes in New York, New York, USA,” available at <https://www.timeanddate.com/time/change/usa/new-york>



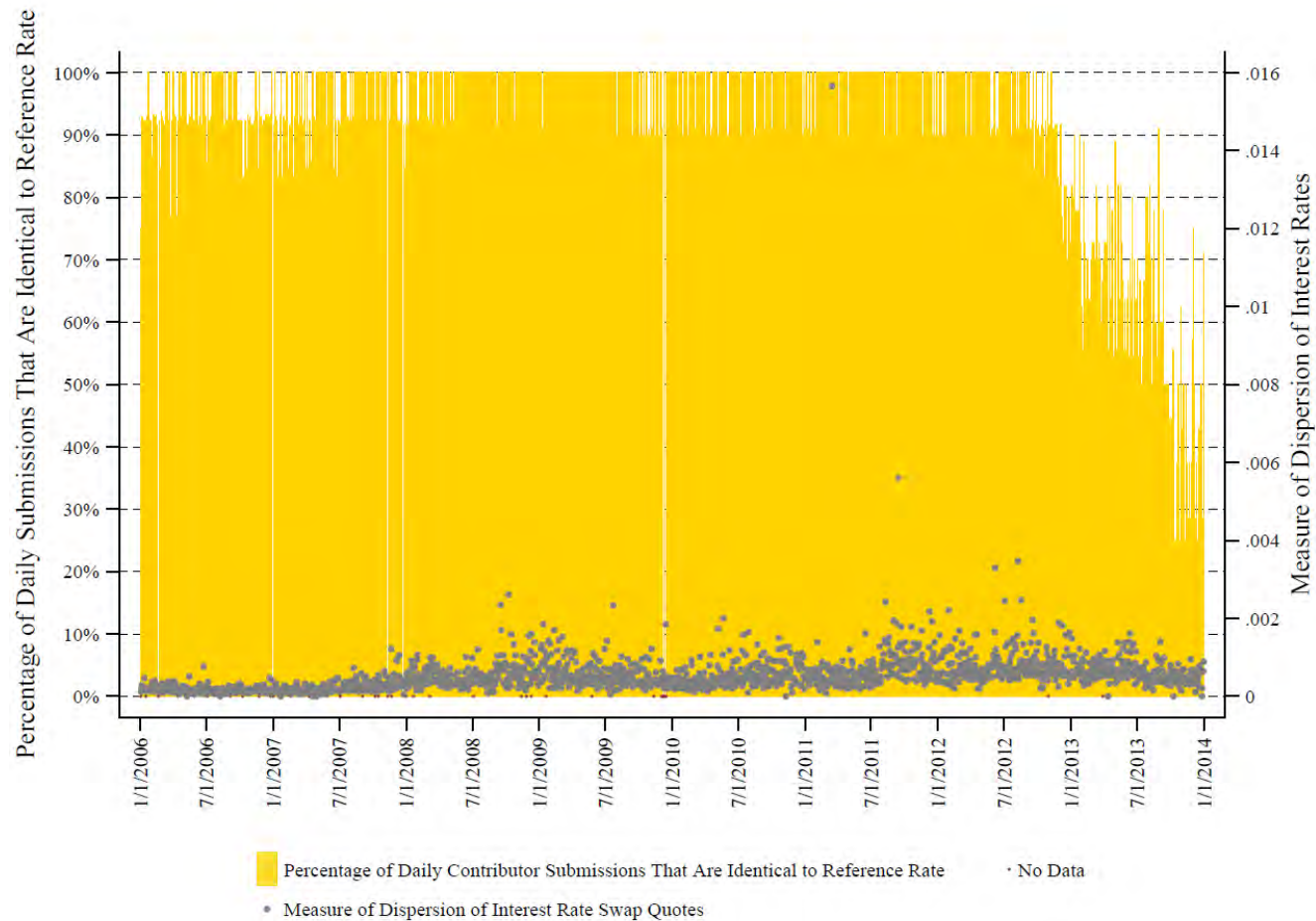
## APPENDIX III: SUPPLEMENTAL FIGURES

FIGURE A1  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 4-YEAR TENOR



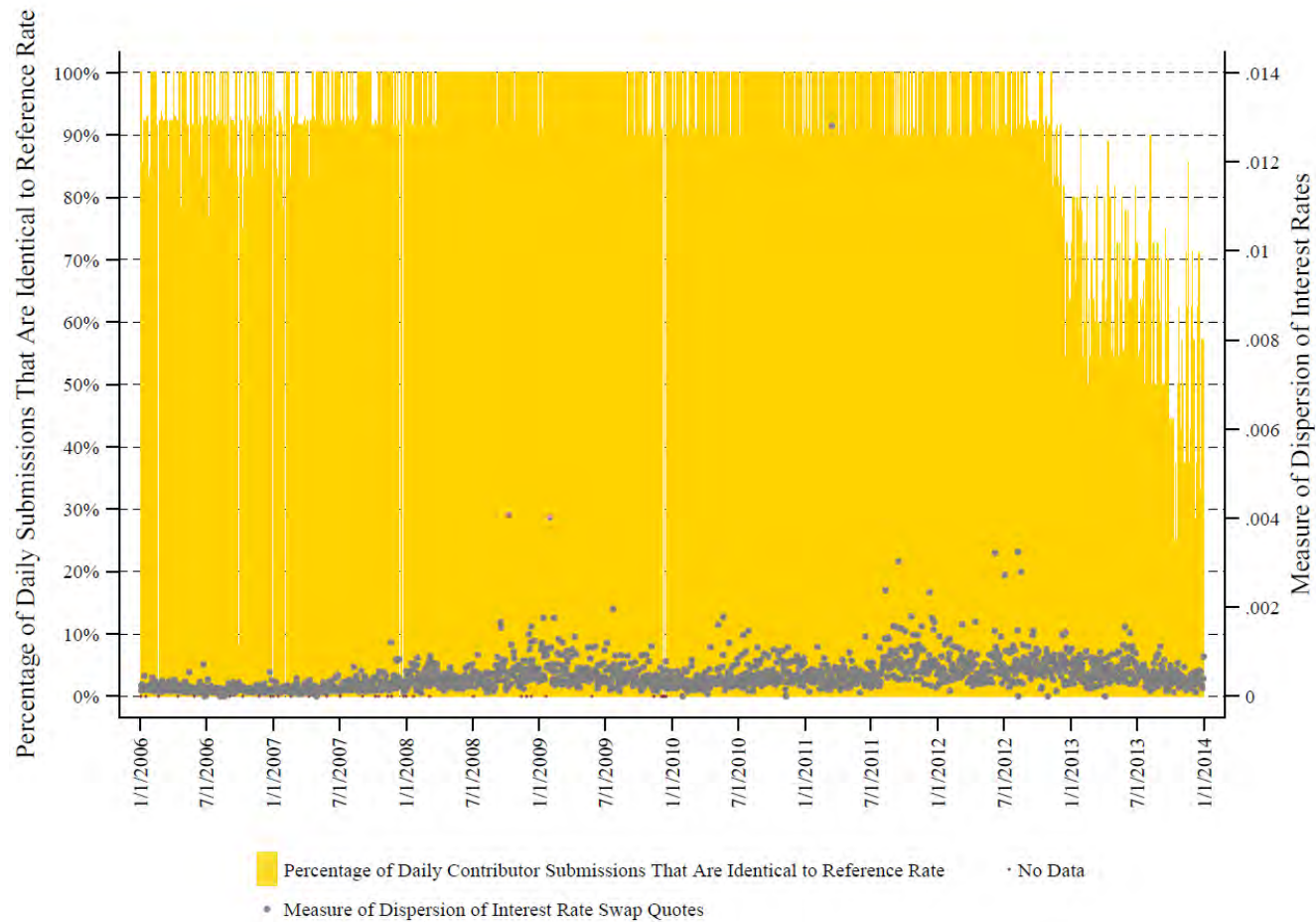
Source: ICAP production data.

FIGURE A2  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 6-YEAR TENOR



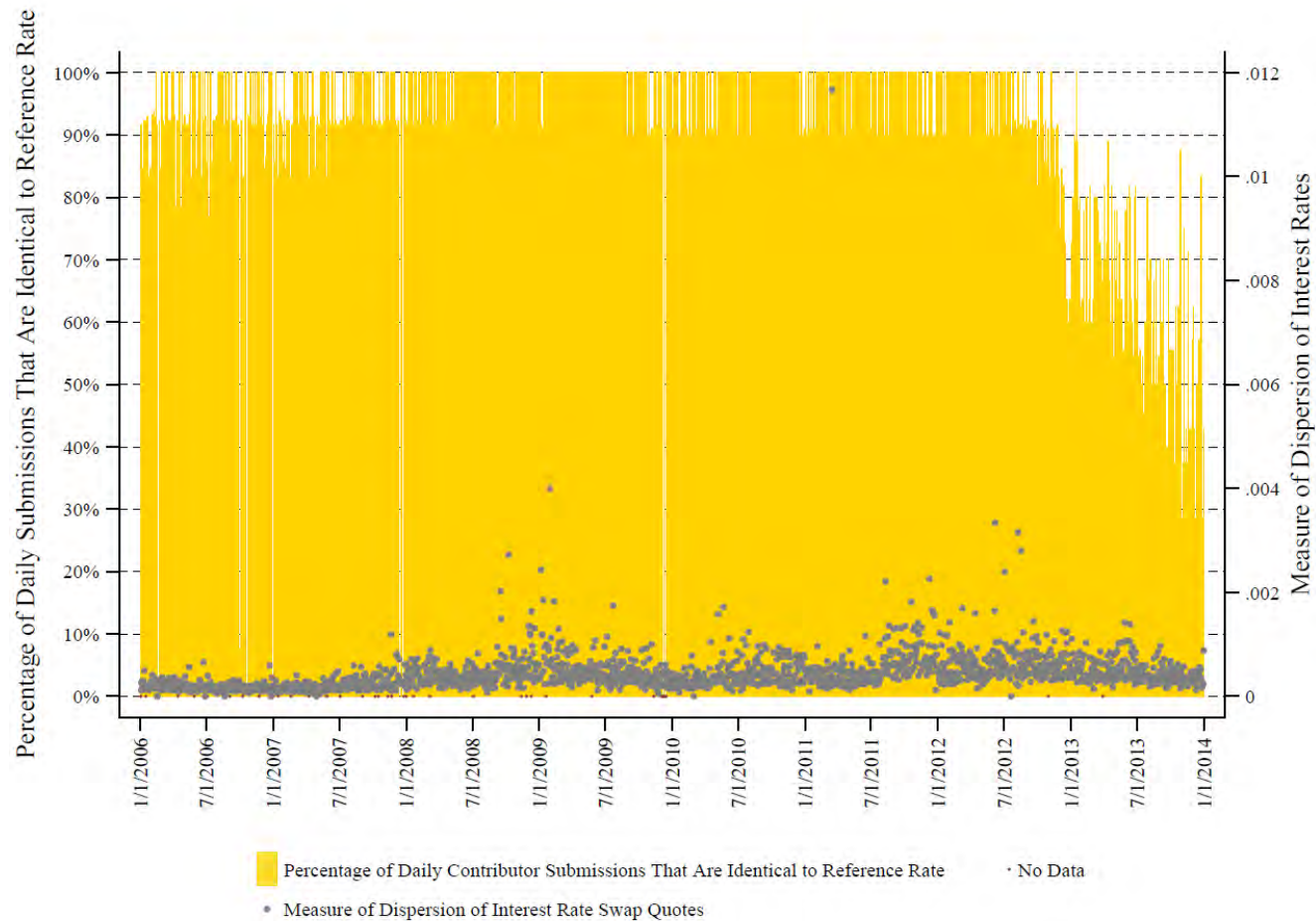
Source: ICAP production data.

FIGURE A3  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 8-YEAR TENOR



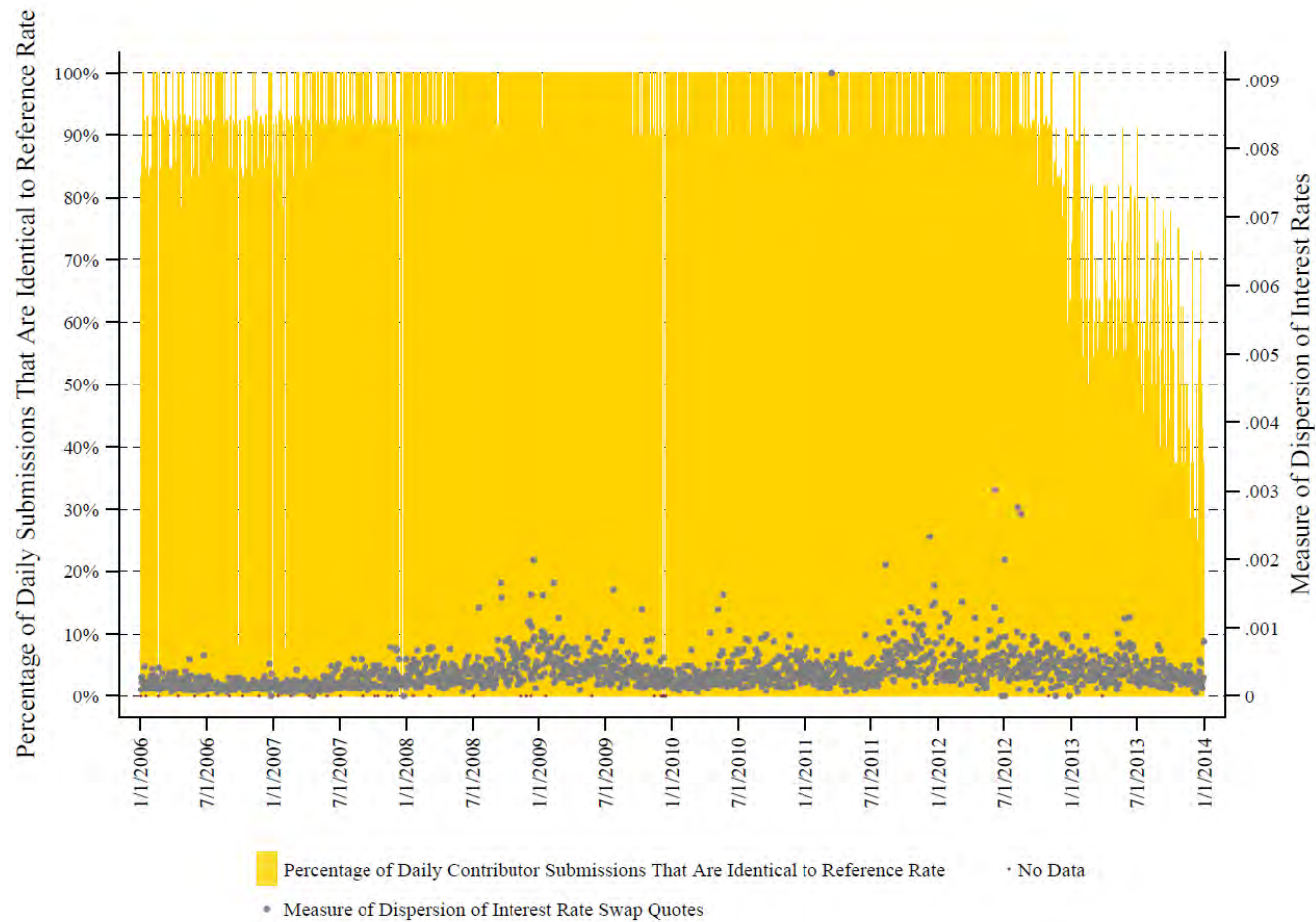
Source: ICAP production data.

FIGURE A4  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 9-YEAR TENOR



Source: ICAP production data.

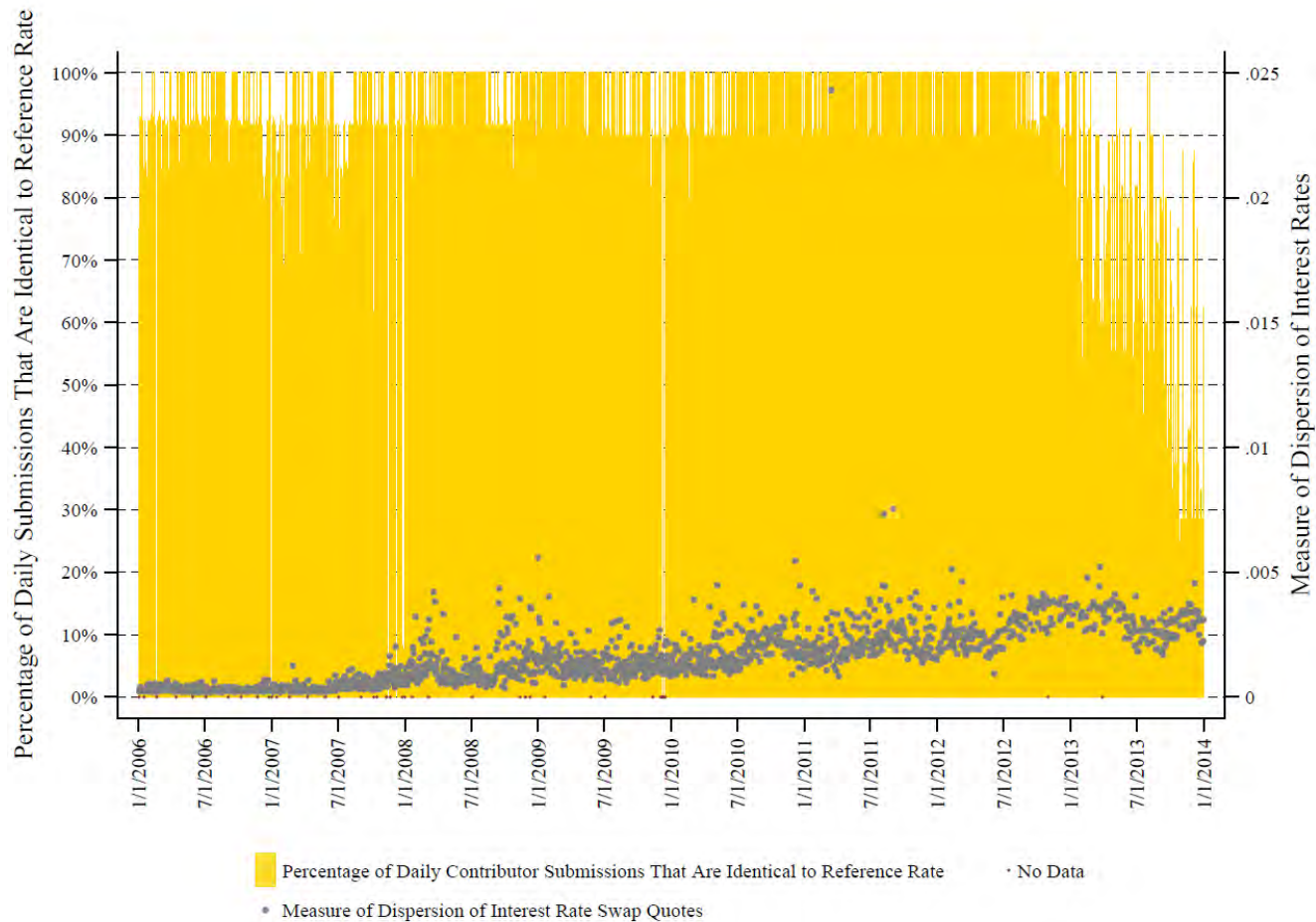
FIGURE A5  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 15-YEAR TENOR



Source: ICAP production data.

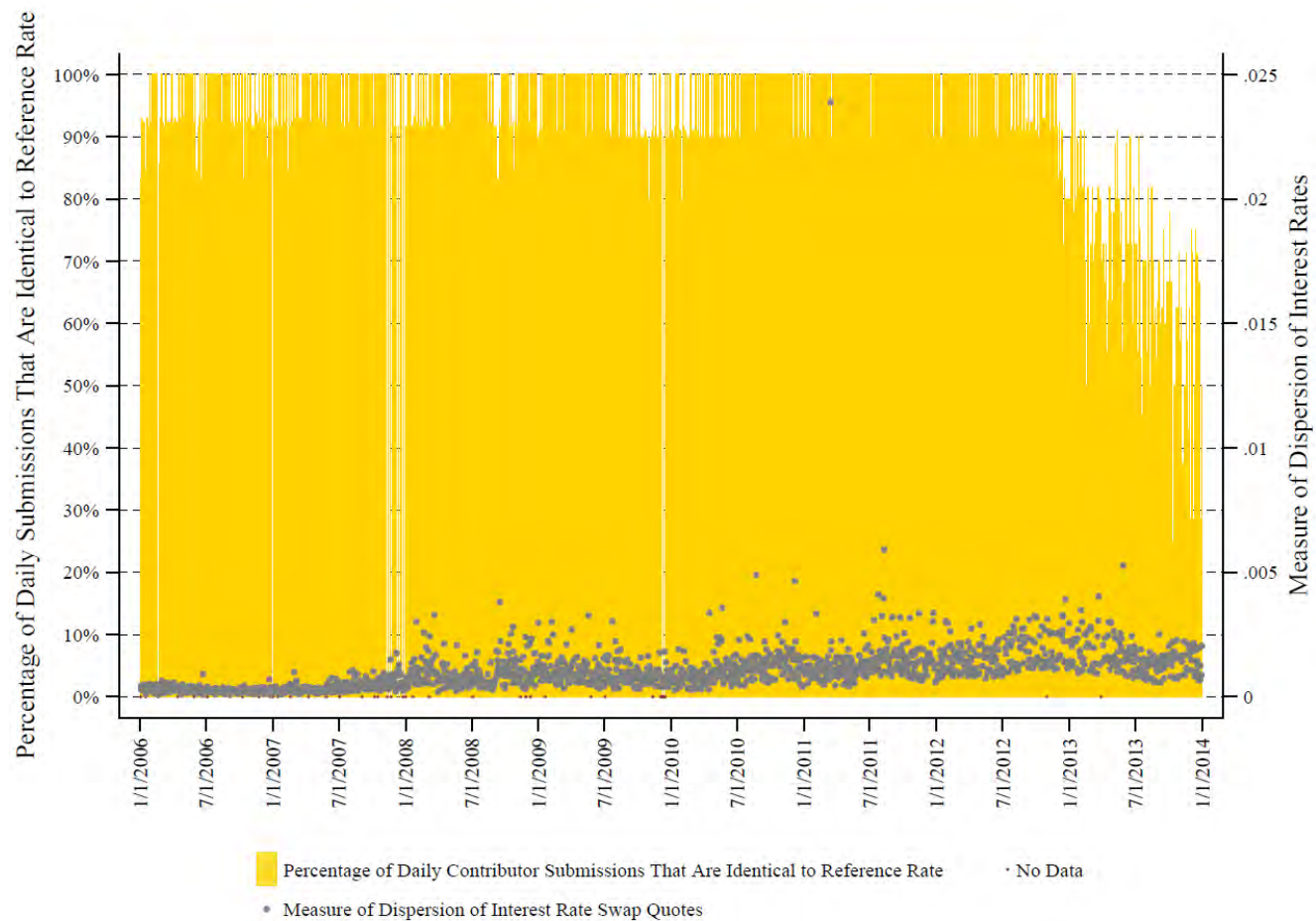


FIGURE A6  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 2-YEAR TENOR



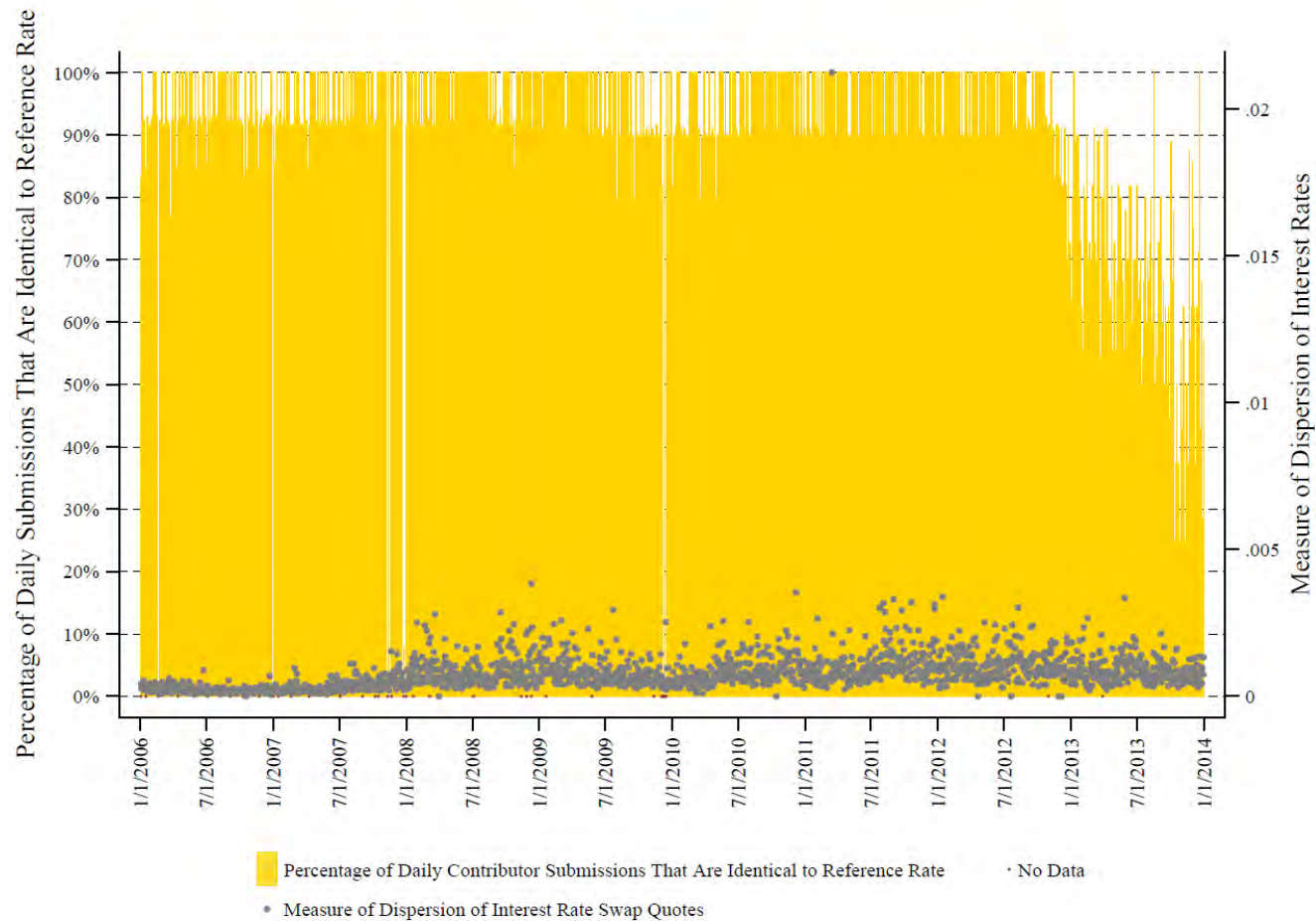
Source: ICAP production data.

FIGURE A7  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 3-YEAR TENOR



Source: ICAP production data.

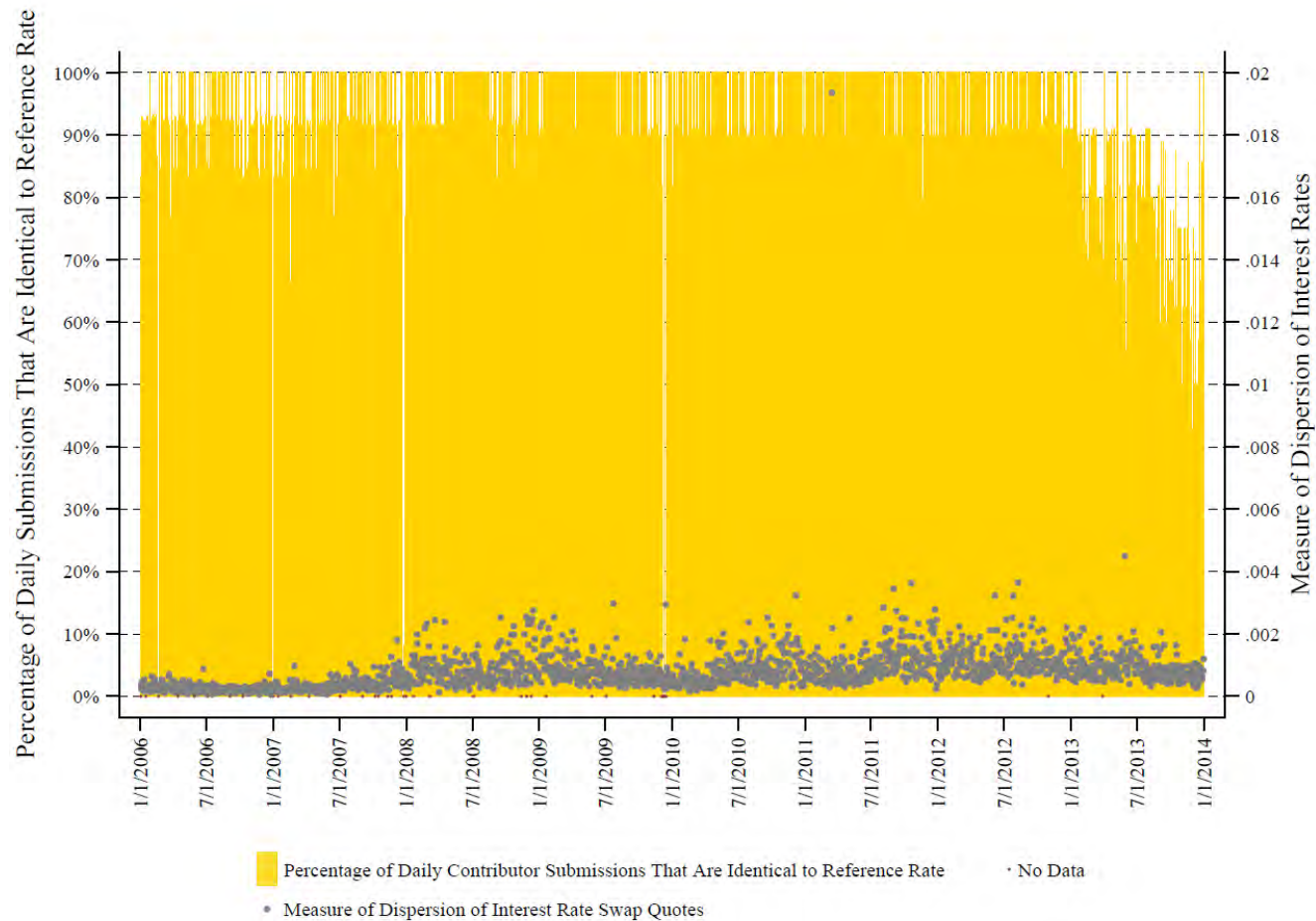
FIGURE A8  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 4-YEAR TENOR



Source: ICAP production data.

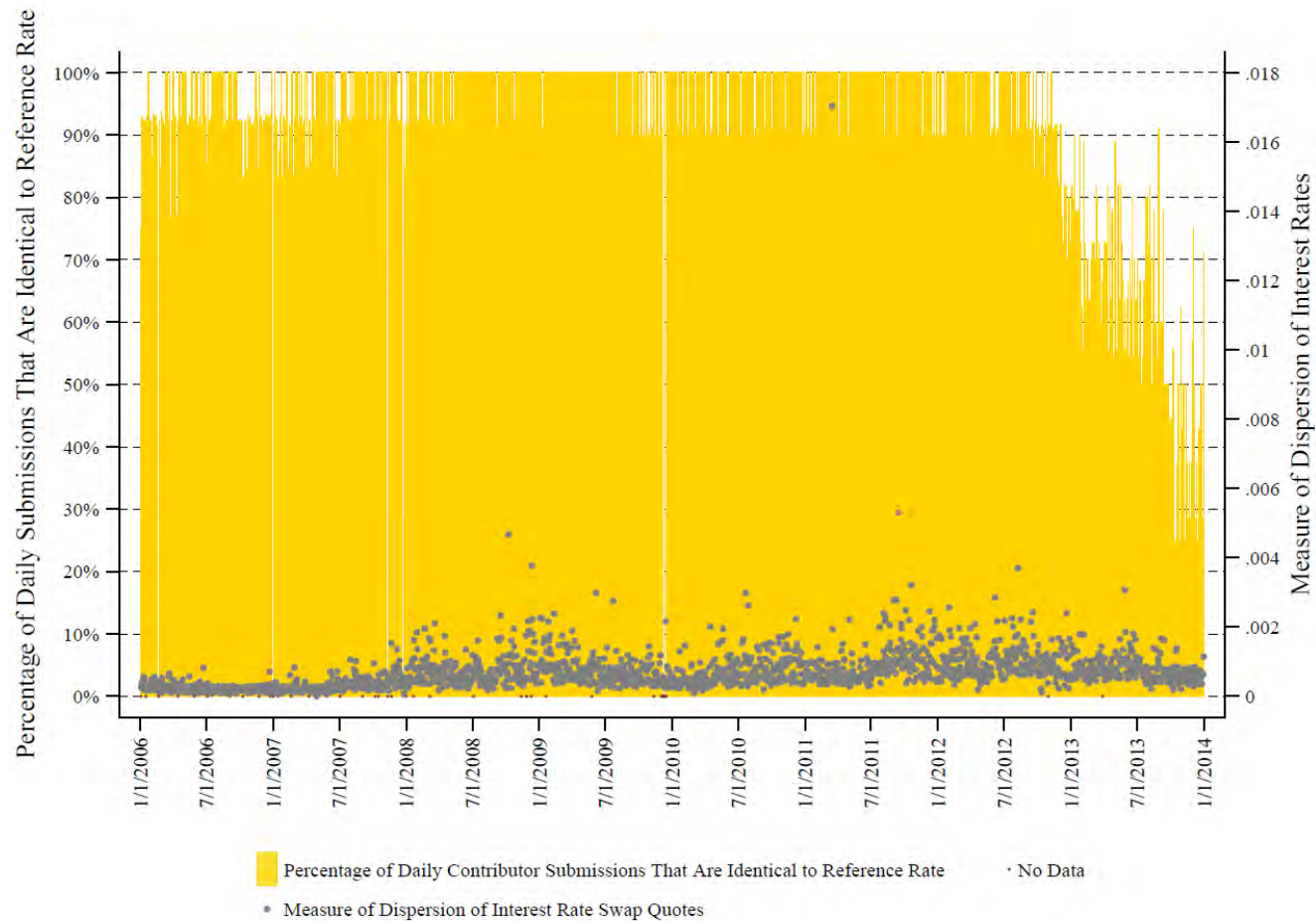


FIGURE A9  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 5-YEAR TENOR



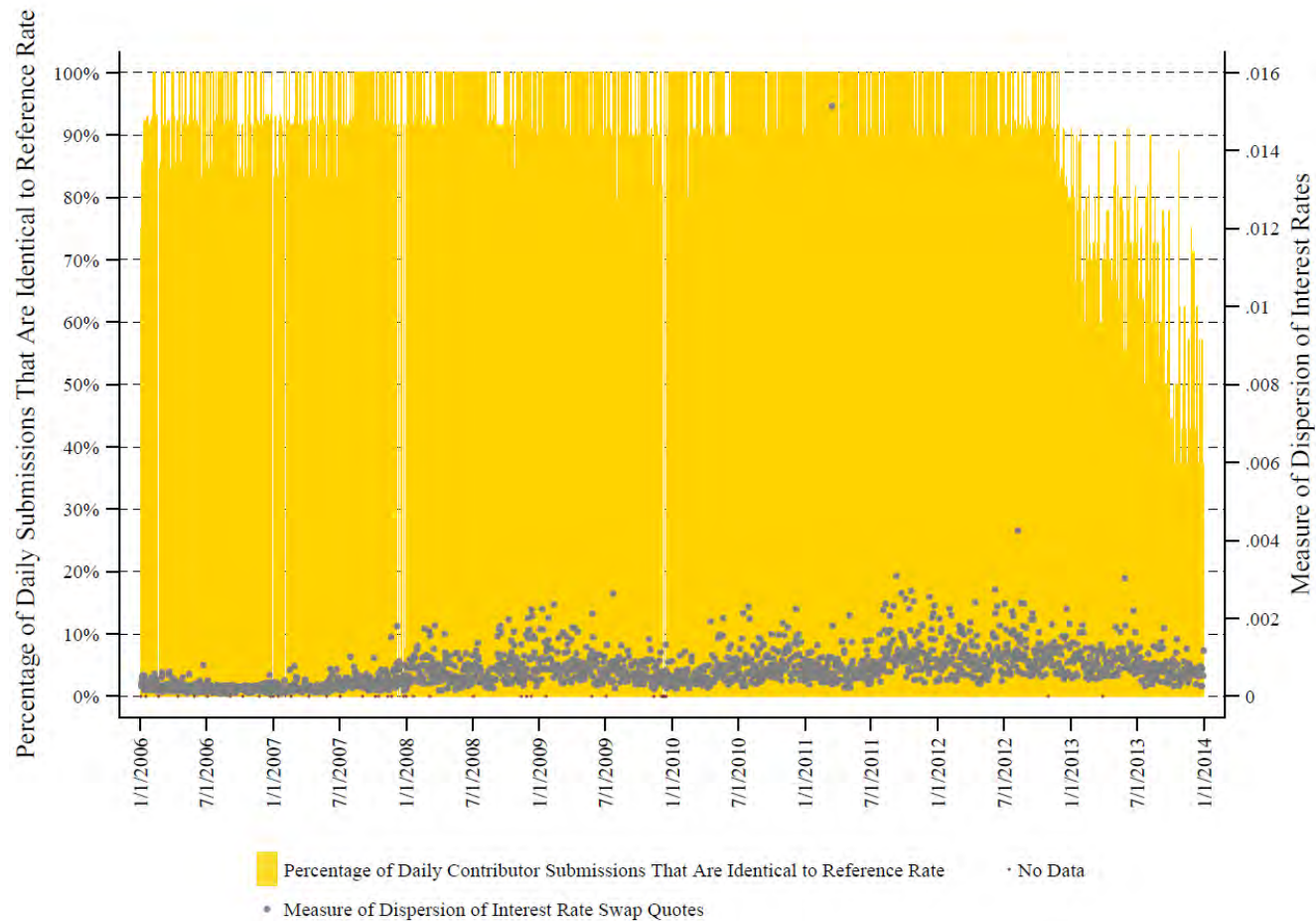
Source: ICAP production data.

FIGURE A10  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 6-YEAR TENOR



Source: ICAP production data.

FIGURE A11  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 7-YEAR TENOR



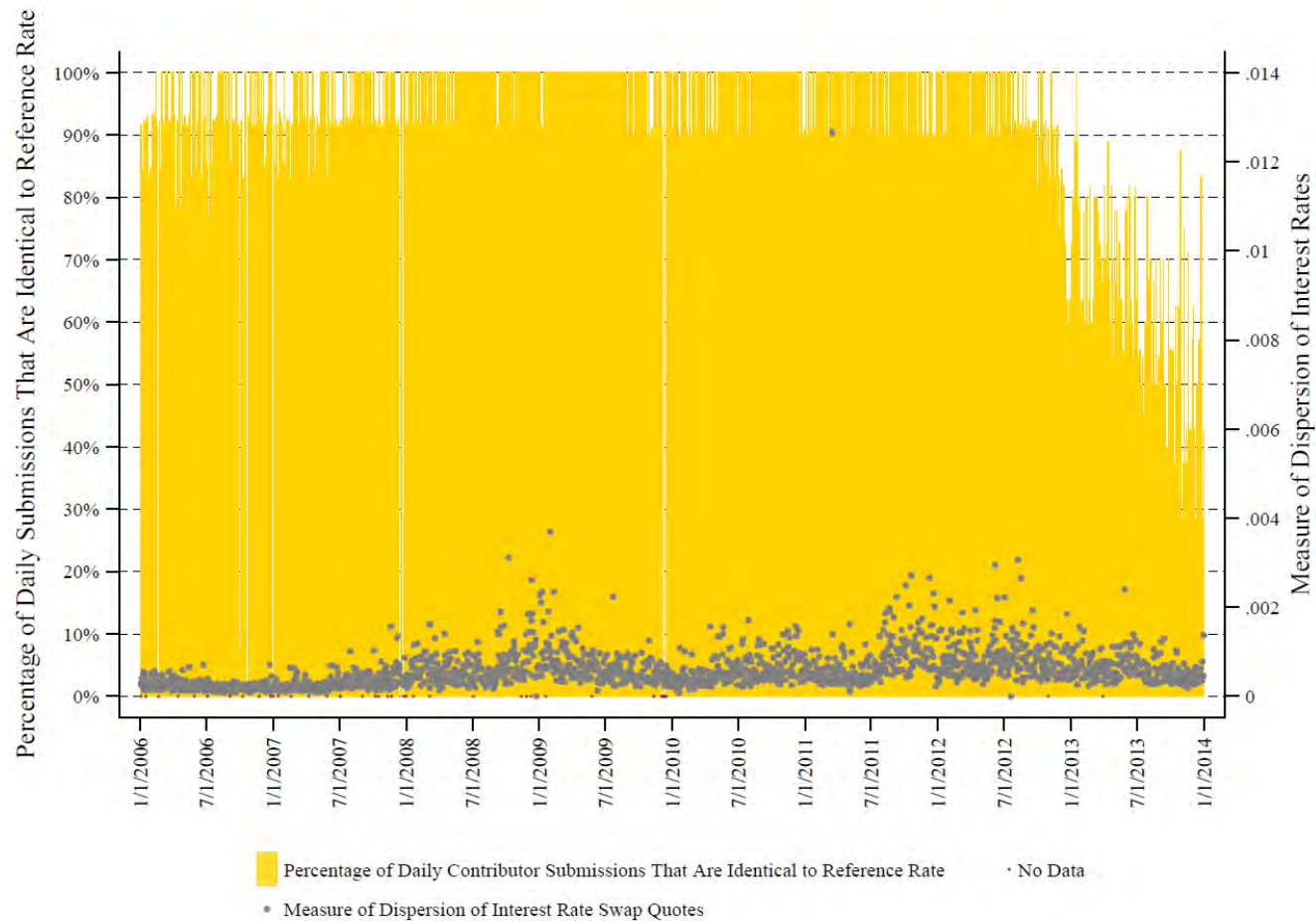
Source: ICAP production data.

FIGURE A12  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 8-YEAR TENOR



Source: ICAP production data.

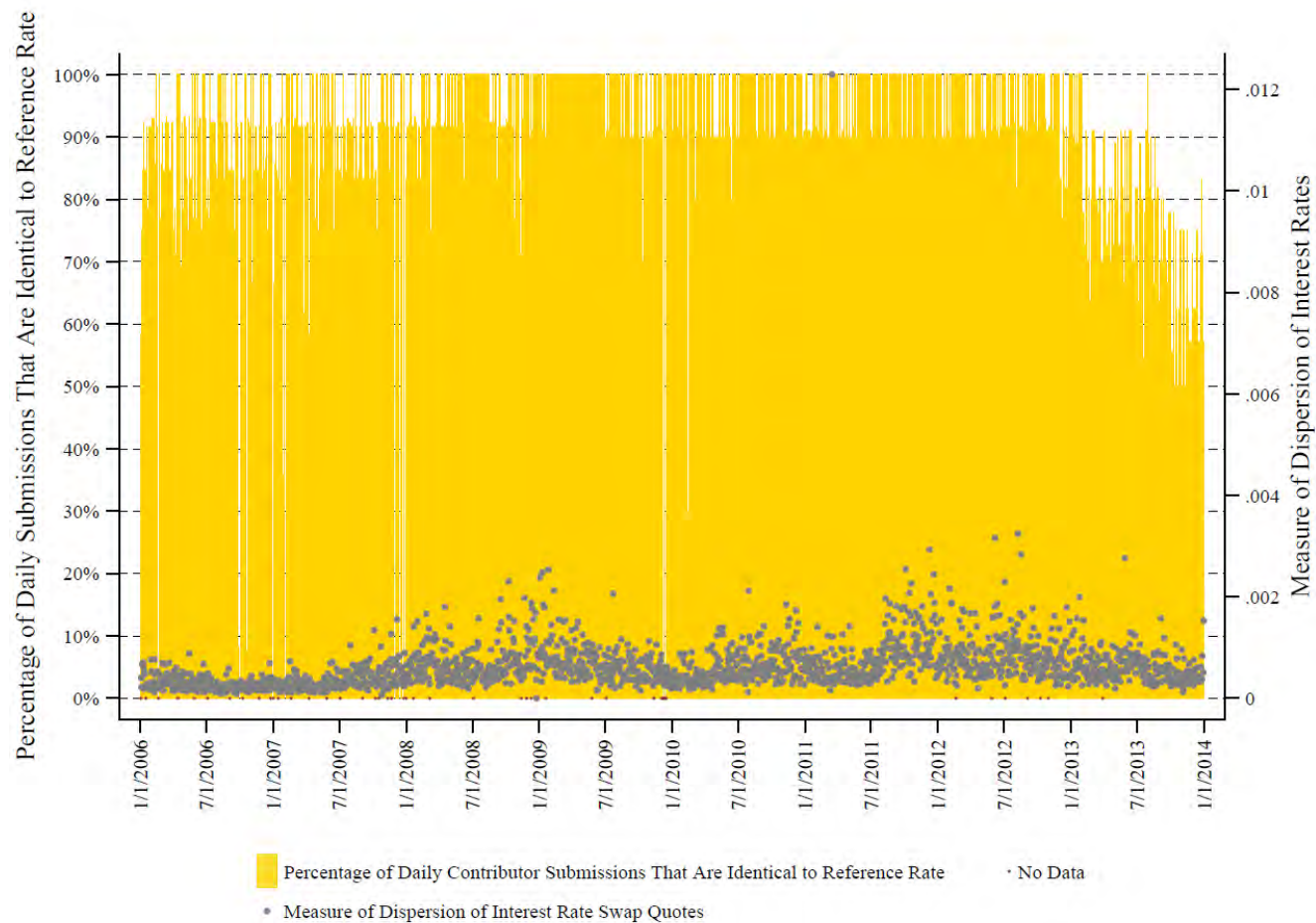
FIGURE A13  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 9-YEAR TENOR



Source: ICAP production data.

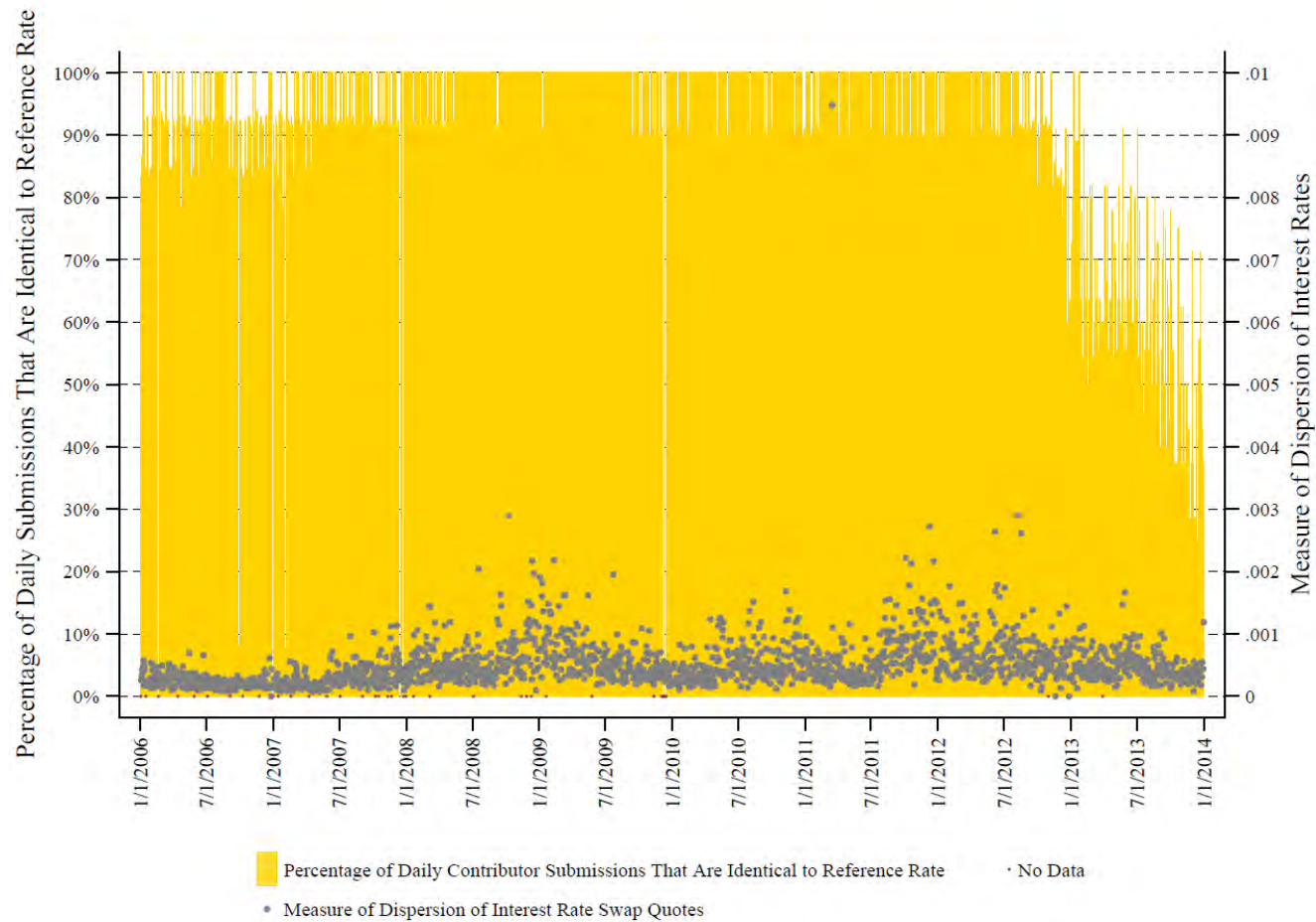


FIGURE A14  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 10-YEAR TENOR



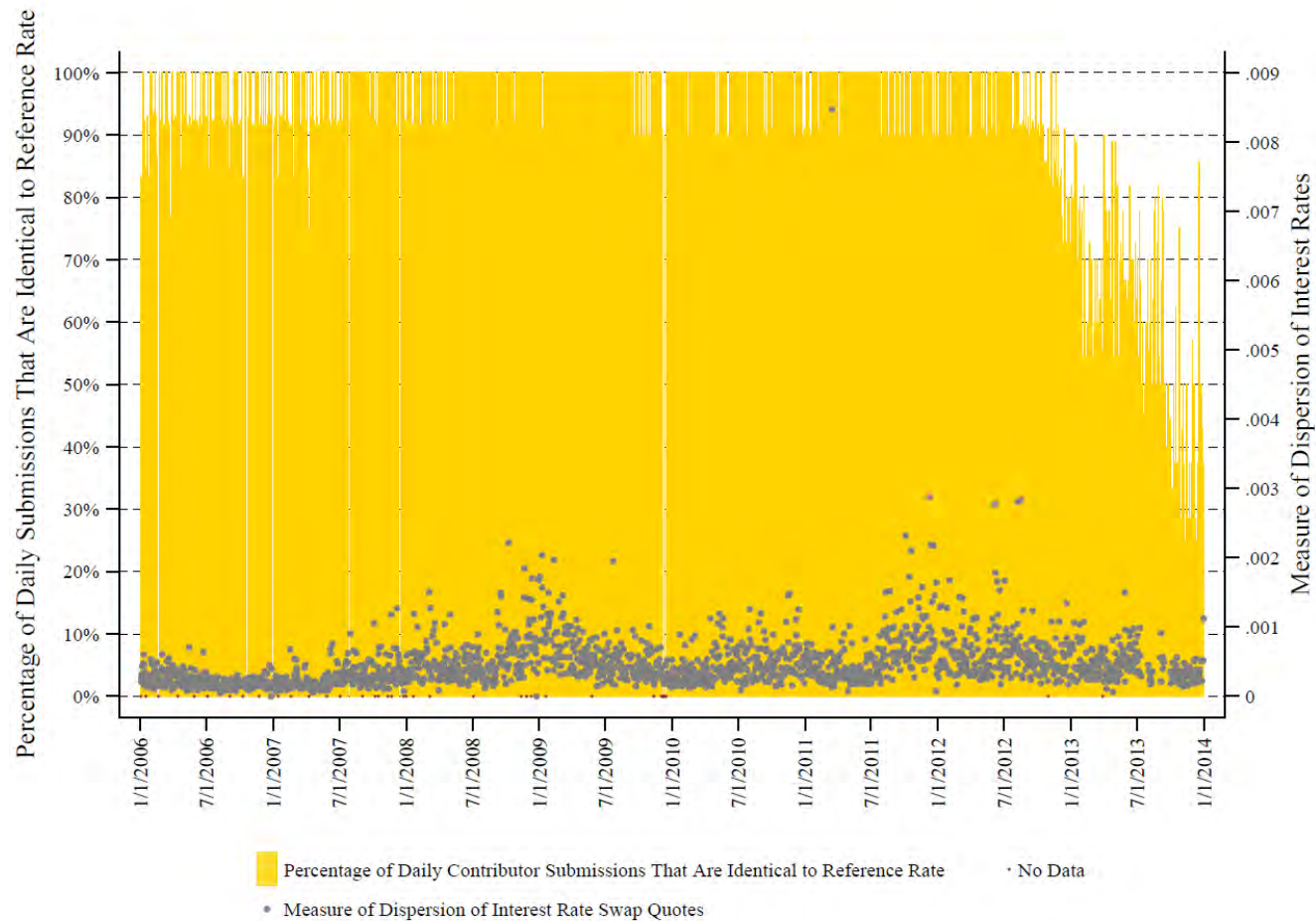
Source: ICAP production data.

FIGURE A15  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 15-YEAR TENOR



Source: ICAP production data.

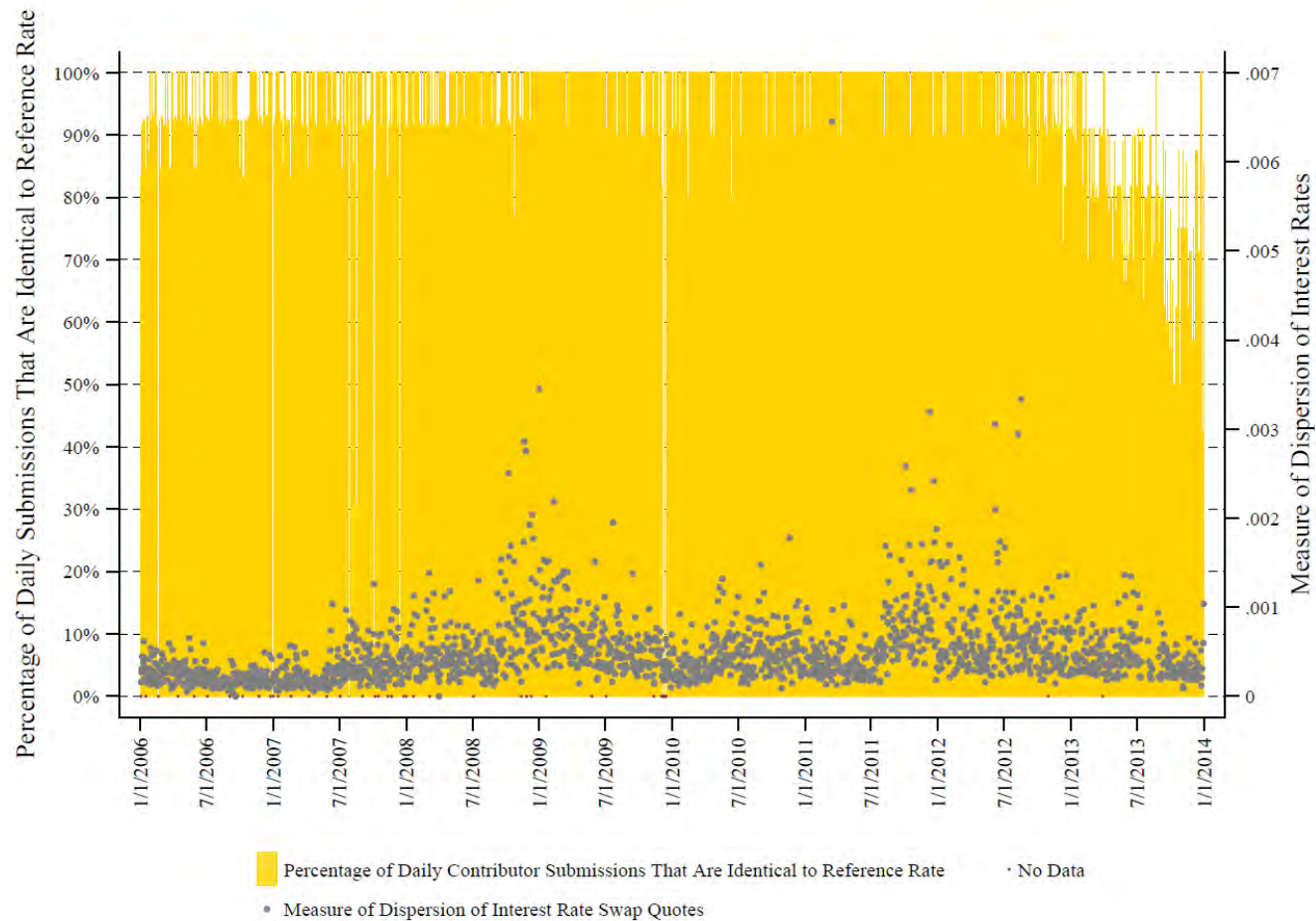
FIGURE A16  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 20-YEAR TENOR



Source: ICAP production data.

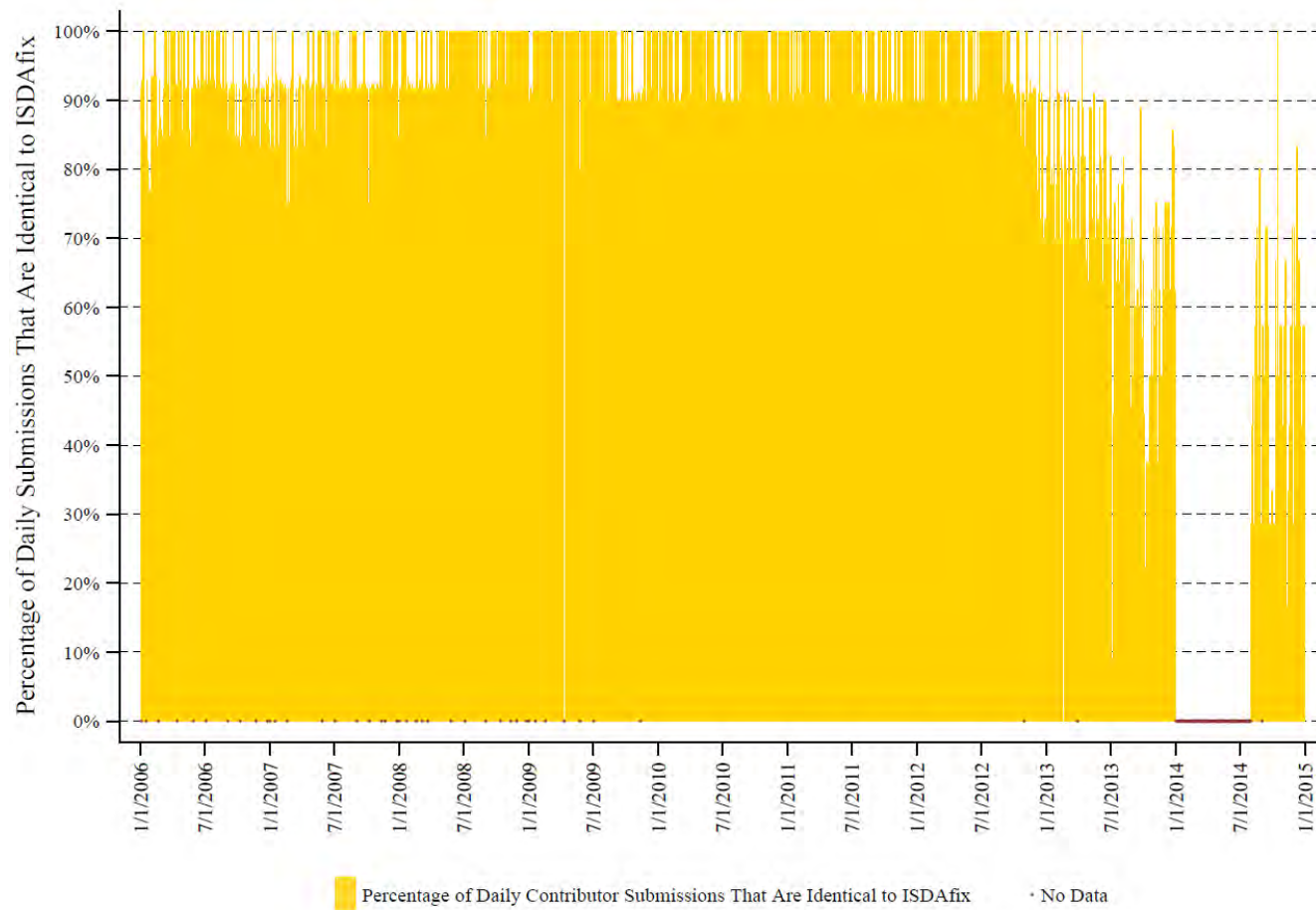


FIGURE A17  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE ICAP REFERENCE RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 10:58:00 AM AND 11:01:59 AM  
 30-YEAR TENOR



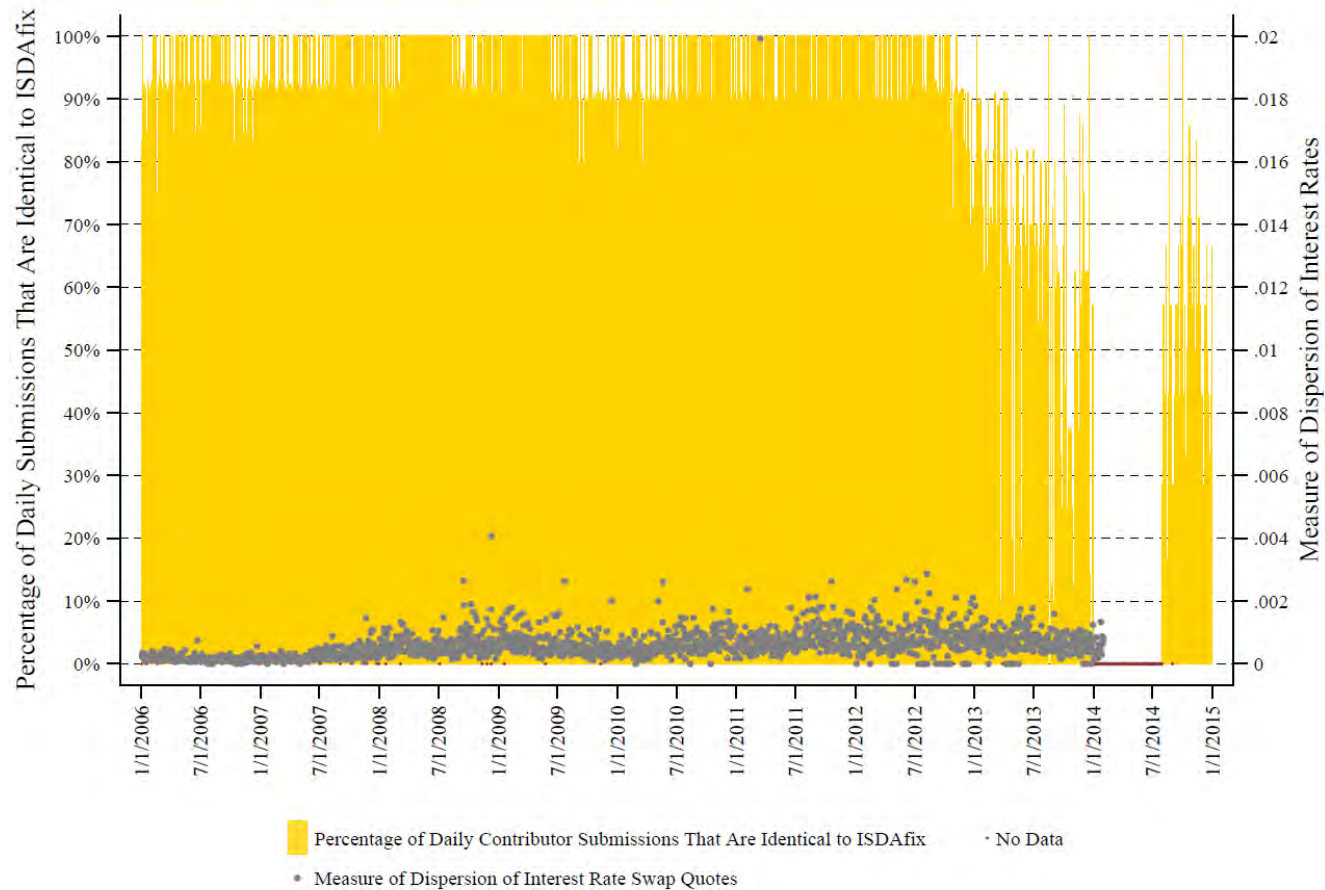
Source: ICAP production data.

FIGURE A18  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE  
 1-YEAR TENOR



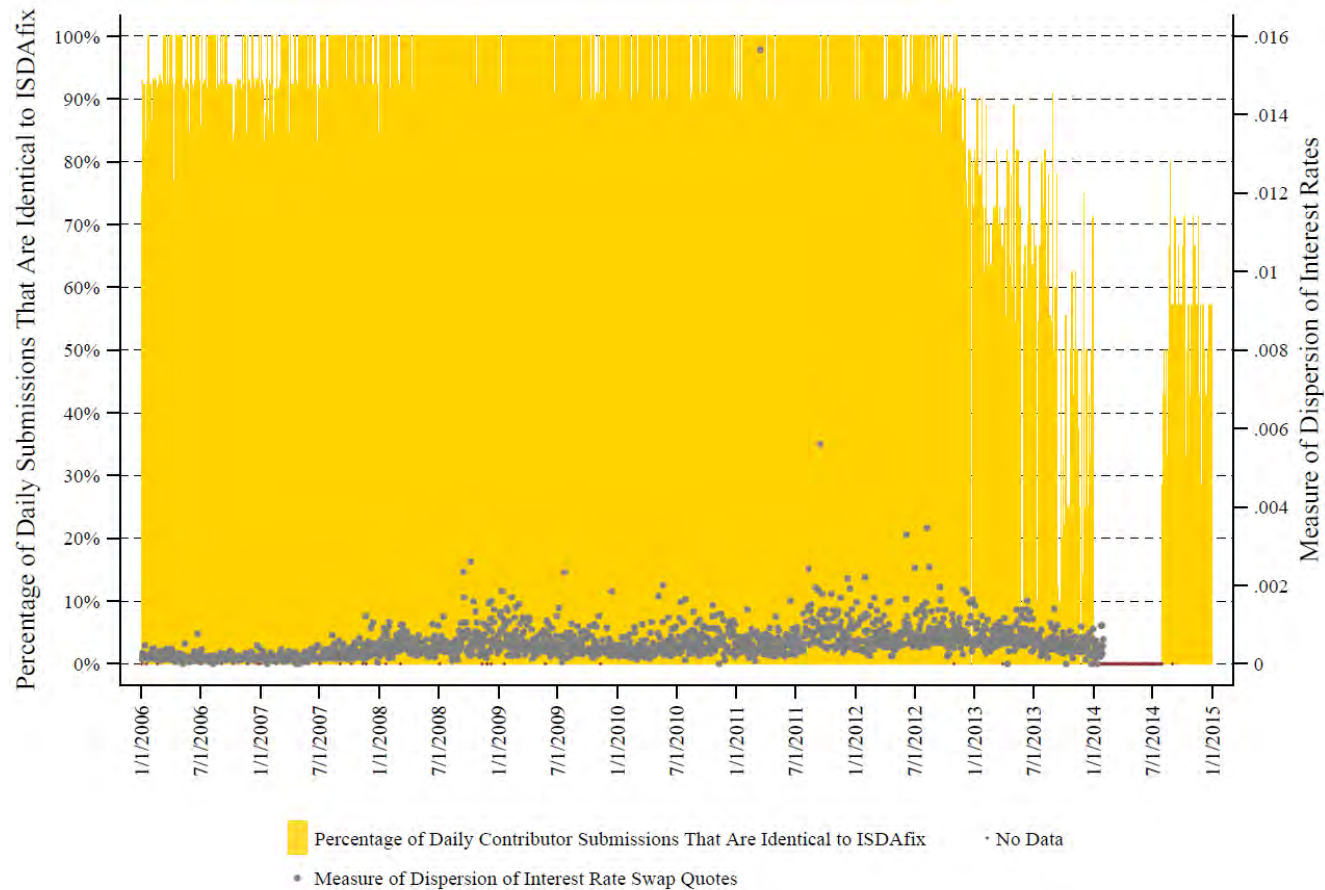
Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

FIGURE A19  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 4-YEAR TENOR



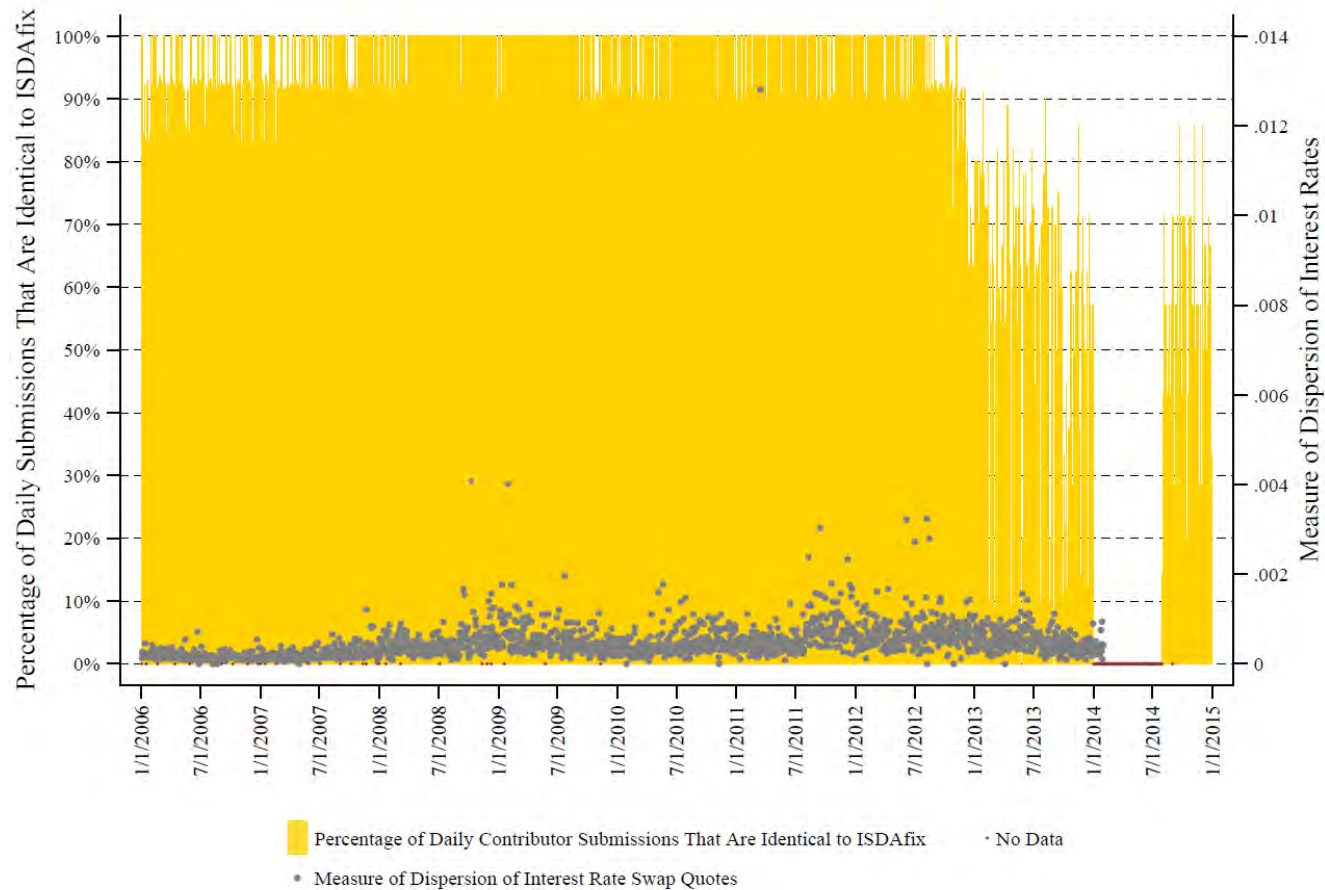
Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

FIGURE A20  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 6-YEAR TENOR



Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.

FIGURE A21  
 PERCENTAGE OF DAILY BANK USD ISDAFIX SUBMISSIONS IDENTICAL TO THE FINAL ISDAFIX RATE AND  
 MEASURE OF DISPERSION OF MARKET RATES BETWEEN 11:00:00 AM AND 11:01:59 AM  
 8-YEAR TENOR



Source: ICAP production data; ISDAfix rate and bank submissions data from Bloomberg.